PRACTICE PROBLEMS

1 A 10-year bond was issued four years ago. The bond is denominated in US dollars, offers a coupon rate of 10% with interest paid semi-annually, and is currently priced at 102% of par. The bond's:

A tenor is six years.

B nominal rate is 5%.

C redemption value is 102% of the par value.

2 A sovereign bond has a maturity of 15 years. The bond is *best* described as a:

A perpetual bond.

B pure discount bond.

C capital market security.

3 A company has issued a floating-rate note with a coupon rate equal to the three-month Libor + 65 basis points. Interest payments are made quarterly on 31 March, 30 June, 30 September, and 31 December. On 31 March and 30 June, the three-month Libor is 1.55% and 1.35%, respectively. The coupon rate for the interest payment made on 30 June is:

A 2.00%.

B 2.10%.

C 2.20%.

4 The legal contract that describes the form of the bond, the obligations of the issuer, and the rights of the bondholders can be *best* described as a bond's:

A covenant.

B indenture.

C debenture.

5 Which of the following is a type of external credit enhancement?

A Covenants

B A surety bond

C Overcollaterization

6 An affirmative covenant is *most likely* to stipulate:

A limits on the issuer's leverage ratio.

B how the proceeds of the bond issue will be used.

C the maximum percentage of the issuer's gross assets that can be sold.

7 Which of the following *best* describes a negative bond covenant? The issuer is:

A required to pay taxes as they come due.

B prohibited from investing in risky projects.

C required to maintain its current lines of business.

8 A South African company issues bonds denominated in pound sterling that are sold to investors in the United Kingdom. These bonds can be *best* described as:

A Eurobonds.

B global bonds.

C foreign bonds.

9 Relative to domestic and foreign bonds, Eurobonds are *most likely* to be:

A bearer bonds.
B registered bonds.
C subject to greater regulation.

10 An investor in a country with an original issue discount tax provision purchases a 20-year zero-coupon bond at a deep discount to par value. The investor plans to hold the bond until the maturity date. The investor will *most likely* report:
A a capital gain at maturity.
B a tax deduction in the year the bond is purchased.
C taxable income from the bond every year until maturity.

11 A bond that is characterized by a fixed periodic payment schedule that reduces the bond's outstanding principal amount to zero by the maturity date is *best* described as a:
A bullet bond.
B plain vanilla bond.
C fully amortized bond.

12 If interest rates are expected to increase, the coupon payment structure *most likely* to benefit the issuer is a:
A step-up coupon.
B inflation-linked coupon.
C cap in a floating-rate note.

13 Investors who believe that interest rates will rise *most likely* prefer to invest in:
A inverse floaters.
B fixed-rate bonds.
C floating-rate notes.

14 A 10-year, capital-indexed bond linked to the Consumer Price Index (CPI) is issued with a coupon rate of 6% and a par value of 1,000. The bond pays interest semi-annually. During the first six months after the bond's issuance, the CPI increases by 2%. On the first coupon payment date, the bond's:
A coupon rate increases to 8%.
B coupon payment is equal to 40.
C principal amount increases to 1,020.

15 The provision that provides bondholders the right to sell the bond back to the issuer at a predetermined price prior to the bond's maturity date is referred to as:
A a put provision.
B a make-whole call provision.
C an original issue discount provision.

16 Which of the following provisions is a benefit to the issuer?
A Put provision
B Call provision
C Conversion provision

17 Relative to an otherwise similar option-free bond, a:
A putable bond will trade at a higher price.
B callable bond will trade at a higher price.
C convertible bond will trade at a lower price.

18 Which type of bond *most likely* earns interest on an implied basis?

A Floater

B Conventional bond

C Pure discount bond

19 Clauses that specify the rights of the bondholders and any actions that the issuer is obligated to perform or is prohibited from performing are:

A covenants.

B collaterals.

C credit enhancements.

20 Which of the following type of debt obligation *most likely* protects bondholders when the assets serving as collateral are non-performing?

A Covered bonds

B Collateral trust bonds

C Mortgage-backed securities

21 Which of the following *best* describes a negative bond covenant? The requirement to:

A insure and maintain assets.

B comply with all laws and regulations.

C maintain a minimum interest coverage ratio.

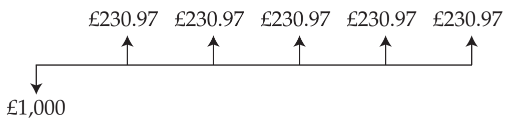
22 Contrary to positive bond covenant, negative covenants are *most likely*:

A costlier.

B legally enforceable.

C enacted at time of issue.

23 A five-year bond has the following cash flows:



The bond can *best* be described as a:

A bullet bond.

B fully amortized bond.

C partially amortized bond.

24 Investors seeking some general protection against a poor economy are *most likely* to select a:

A deferred coupon bond.

B credit-linked coupon bond.

C payment-in-kind coupon bond.

25 The benefit to the issuer of a deferred coupon bond is *most likely* related to:

A tax management.

B cash flow management.

C original issue discount price.

26 Which of the following bond types provides the *most* benefit to a bondholder when bond prices are declining?

A Callable

B Plain vanilla

C Multiple put

27 Which type of call bond option offers the *greatest* flexibility as to when the issuer can exercise the option?

A A Bermuda call

B A European call

C An American call

28 Which of the following *best* describes a convertible bond's conversion premium?

A Bond price minus conversion value

B Par value divided by conversion price

C Current share price multiplied by conversion ratio

SOLUTIONS

1 A is correct. The tenor of the bond is the time remaining until the bond's maturity date. Although the bond had a maturity of 10 years at issuance (original maturity), it was issued four years ago. Thus, there are six years remaining until the maturity date.

B is incorrect because the nominal rate is the coupon rate, i.e., the interest rate that the issuer agrees to pay each year until the maturity date. Although interest is paid semi-annually, the nominal rate is 10%, not 5%. C is incorrect because it is the bond's price, not its redemption value (also called principal amount, principal value, par value, face value, nominal value, or maturity value), that is equal to 102% of the par value.

2 C is correct. A capital market security has an original maturity longer than one year.

A is incorrect because a perpetual bond does not have a stated maturity date. Thus, the sovereign bond, which has a maturity of 15 years, cannot be a perpetual bond. B is incorrect because a pure discount bond is a bond issued at a discount to par value and redeemed at par. Some sovereign bonds (e.g., Treasury bills) are pure discount bonds, but others are not.

3 C is correct. The coupon rate that applies to the interest payment due on 30 June is based on the three-month Libor rate prevailing on 31 March. Thus, the coupon rate is 1.55% + 0.65% = 2.20%.

4 B is correct. The indenture, also referred to as trust deed, is the legal contract that describes the form of the bond, the obligations of the issuer, and the rights of the bondholders.

A is incorrect because covenants are only one element of a bond's indenture. Covenants are clauses that specify the rights of the bondholders and any actions that the issuer is obligated to perform or prohibited from performing. C is incorrect because a debenture is a type of bond.

5 B is correct. A surety bond is an external credit enhancement, i.e., a guarantee received from a third party. If the issuer defaults, the guarantor who provided the surety bond will reimburse investors for any losses, usually up to a maximum amount called the penal sum.

A is incorrect because covenants are legally enforceable rules that borrowers and lenders agree upon when the bond is issued. C is incorrect because overcollateralization is an internal, not external, credit enhancement. Collateral is a guarantee underlying the debt above and beyond the issuer's promise to pay, and overcollateralization refers to the process of posting more collateral than is needed to obtain or secure financing. Collateral, such as assets or securities pledged to ensure debt payments, is not provided by a third party. Thus, overcollateralization is not an external credit enhancement.

6 B is correct. Affirmative (or positive) covenants enumerate what issuers are required to do and are typically administrative in nature. A common affirmative covenant describes what the issuer intends to do with the proceeds from the bond issue.

A and C are incorrect because imposing a limit on the issuer's leverage ratio or on the percentage of the issuer's gross assets that can be sold are negative covenants. Negative covenants prevent the issuer from taking actions that could reduce its ability to make interest payments and repay the principal.

7 B is correct. Prohibiting the issuer from investing in risky projects restricts the issuer's potential business decisions. These restrictions are referred to as negative bond covenants.

A and C are incorrect because paying taxes as they come due and maintaining the current lines of business are positive covenants.

8 C is correct. Bonds sold in a country and denominated in that country's currency by an entity from another country are referred to as foreign bonds.

A is incorrect because Eurobonds are bonds issued outside the jurisdiction of any single country. B is incorrect because global bonds are bonds issued in the Eurobond market and at least one domestic country simultaneously.

9 A is correct. Eurobonds are typically issued as bearer bonds, i.e., bonds for which the trustee does not keep records of ownership. In contrast, domestic and foreign bonds are typically registered bonds for which ownership is recorded by either name or serial number.

B is incorrect because Eurobonds are typically issued as bearer bonds, not registered bonds. C is incorrect because Eurobonds are typically subject to lower, not greater, regulation than domestic and foreign bonds.

10 C is correct. The original issue discount tax provision requires the investor to include a prorated portion of the original issue discount in his taxable income every tax year until maturity. The original issue discount is equal to the difference between the bond's par value and its original issue price.

A is incorrect because the original issue discount tax provision allows the investor to increase his cost basis in the bond so that when the bond matures, he faces no capital gain or loss. B is incorrect because the original issue discount tax provision does not require any tax deduction in the year the bond is purchased or afterwards.

11 C is correct. A fully amortized bond calls for equal cash payments by the bond's issuer prior to maturity. Each fixed payment includes both an interest payment component and a principal repayment component such that the bond's outstanding principal amount is reduced to zero by the maturity date.

A and B are incorrect because a bullet bond or plain vanilla bond only make interest payments prior to maturity. The entire principal repayment occurs at maturity.

12 C is correct. A cap in a floating-rate note (capped FRN) prevents the coupon rate from increasing above a specified maximum rate. This feature benefits the issuer in a rising interest rate environment because it sets a limit to the interest rate paid on the debt.

A is incorrect because a bond with a step-up coupon is one in which the coupon, which may be fixed or floating, increases by specified margins at specified dates. This feature benefits the bondholders, not the issuer, in a rising interest rate environment because it allows bondholders to receive a higher coupon in line with the higher market interest rates. B is incorrect because inflation-linked bonds have their coupon payments and/or principal repayment linked to an index of consumer prices. If interest rates increase as a result of inflation, this feature is a benefit for the bondholders, not the issuer.

13 C is correct. In contrast to fixed-rate bonds that decline in value in a rising interest rate environment, floating-rate notes (FRNs) are less affected when interest rates increase because their coupon rates vary with market interest rates and are reset at regular, short-term intervals. Consequently, FRNs are favored by investors who believe that interest rates will rise.

A is incorrect because an inverse floater is a bond whose coupon rate has an inverse relationship to the reference rate, so when interest rates rise, the coupon rate on an inverse floater decreases. Thus, inverse floaters are favored by investors who believe that interest rates will decline, not rise. B is incorrect because fixed rate-bonds decline in value in a rising interest rate environment. Consequently, investors who expect interest rates to rise will likely avoid investing in fixed-rate bonds.

14 C is correct. Capital-indexed bonds pay a fixed coupon rate that is applied to a principal amount that increases in line with increases in the index during the bond's life. If the consumer price index increases by 2%, the coupon rate remains unchanged at 6%, but the principal amount increases by 2% and the coupon payment is based on the inflation-adjusted principal amount. On the first coupon payment date, the inflation-adjusted principal amount is $1,000 \times (1 + 0.02) = 1,020$ and the semi-annual coupon payment is equal to $(0.06 \times 1,020) \div 2 = 30.60$.

15 A is correct. A put provision provides bondholders the right to sell the bond back to the issuer at a predetermined price prior to the bond's maturity date.

B is incorrect because a make-whole call provision is a form of call provision; i.e., a provision that provides the issuer the right to redeem all or part of the bond before its maturity date. A make-whole call provision requires the issuer to make a lump sum payment to the bondholders based on the present value of the future coupon payments and principal repayments not paid because of the bond being redeemed early by the issuer. C is incorrect because an original issue discount provision is a tax provision relating to bonds issued at a discount to par value. The original issue discount tax provision typically requires the bondholders to include a prorated portion of the original issue discount (i.e., the difference between the par value and the original issue price) in their taxable income every tax year until the bond's maturity date.

16 B is correct. A call provision (callable bond) gives the issuer the right to redeem all or part of the bond before the specified maturity date. If market interest rates decline or the issuer's credit quality improves, the issuer of a callable bond can redeem it and replace it by a cheaper bond. Thus, the call provision is beneficial to the issuer.

A is incorrect because a put provision (putable bond) is beneficial to the bondholders. If interest rates rise, thus lowering the bond's price, the bondholders have the right to sell the bond back to the issuer at a predetermined price on specified dates. C is incorrect because a conversion provision (convertible bond) is beneficial to the bondholders. If the issuing company's share price increases, the bondholders have the right to exchange the bond for a specified number of common shares in the issuing company.

17 A is correct. A put feature is beneficial to the bondholders. Thus, the price of a putable bond will typically be higher than the price of an otherwise similar non-putable bond.

B is incorrect because a call feature is beneficial to the issuer. Thus, the price of a callable bond will typically be lower, not higher, than the price of an otherwise similar non-callable bond. C is incorrect because a conversion feature is beneficial to the bondholders. Thus, the price of a convertible bond will typically be higher, not lower, than the price of an otherwise similar non-convertible bond.

18 C is correct. A zero-coupon, or pure discount, bond pays no interest; instead, it is issued at a discount to par value and redeemed at par. As a result, the interest earned is implied and equal to the difference between the par value and the purchase price.

19 A is correct. Covenants specify the rights of the bondholders and any actions that the issuer is obligated to perform or is prohibited from performing.

20 A is correct. A covered bond is a debt obligation backed by a segregated pool of assets called a "cover pool." When the assets that are included in the cover pool become non-performing (i.e., the assets are not generating the promised cash flows), the issuer must replace them with performing assets.

21 C is correct. Negative covenants enumerate what issuers are prohibited from doing. Restrictions on debt, including maintaining a minimum interest coverage ratio or a maximum debt usage ratio, are typical examples of negative covenants.

22 A is correct. Affirmative covenants typically do not impose additional costs to the issuer, while negative covenants are frequently costly. B is incorrect because all bond covenants are legally enforceable rules, so there is no difference in this regard between positive and negative bond covenants. C is incorrect because borrowers and lenders agree on all bond covenants at the time of a new bond issue, so there is no difference in this regard between positive and negative bond covenants.

23 B is correct. A bond that is fully amortized is characterized by a fixed periodic payment schedule that reduces the bond's outstanding principal amount to zero by the maturity date. The stream of £230.97 payments reflects the cash flows of a fully amortized bond with a coupon rate of 5% and annual interest payments.

24 B is correct. A credit-linked coupon bond has a coupon that changes when the bond's credit rating changes. Because credit ratings tend to decline the most during recessions, credit-linked coupon bonds may thus provide some general protection against a poor economy by offering increased coupon payments when credit ratings decline.

25 B is correct. Deferred coupon bonds pay no coupon for their first few years but then pay higher coupons than they otherwise normally would for the remainder of their life. Deferred coupon bonds are common in project financing when the assets being developed may not generate any income during the development phase, thus not providing cash flows to make interest payments. A deferred coupon bond allows the issuer to delay interest payments until the project is completed and the cash flows generated by the assets can be used to service the debt.

26 C is correct. A putable bond is beneficial for the bondholder by guaranteeing a prespecified selling price at the redemption date, thus offering protection when interest rates rise and bond prices decline. Relative to a one-time put bond that incorporates a single sellback opportunity, a multiple put bond offers more frequent sellback opportunities, thus providing the most benefit to bondholders.

27 C is correct. An American call option gives the issuer the right to call the bond at any time starting on the first call date.

28 A is correct. The conversion premium is the difference between the convertible bond's price and its conversion value.

PRACTICE PROBLEMS

1 In most countries, the bond market sector with the smallest amount of bonds outstanding is *most likely* the:

A government sector.

B financial corporate sector.

C non-financial corporate sector.

2 The distinction between investment grade debt and non-investment grade debt is *best* described by differences in:

A tax status.

B credit quality.

C maturity dates.

3 A bond issued internationally, outside the jurisdiction of the country in whose currency the bond is denominated, is *best* described as a:

A Eurobond.

B foreign bond.

C municipal bond.

4 When classified by type of issuer, asset-backed securities are part of the:

A corporate sector.

B structured finance sector.

C government and government-related sector.

5 Compared with developed markets bonds, emerging markets bonds *most likely*:

A offer lower yields.

B exhibit higher risk.

C benefit from lower growth prospects.

6 With respect to floating-rate bonds, a reference rate such as the London interbank offered rate (Libor) is *most likely* used to determine the bond's:

A spread.

B coupon rate.

C frequency of coupon payments.

7 The variability of the coupon rate on a Libor-based floating-rate bond is *most likely* due to:

A periodic resets of the reference rate.

B market-based reassessments of the issuer's creditworthiness.

C changing estimates by the Libor administrator of borrowing capacity.

8 Which of the following statements is *most accurate*? An interbank offered rate:

A is a single reference rate.

B applies to borrowing periods of up to 10 years.

C is used as a reference rate for interest rate swaps.

9 An investment bank that underwrites a bond issue *most likely*:

A buys and resells the newly issued bonds to investors or dealers.

B acts as a broker and receives a commission for selling the bonds to investors.

C incurs less risk associated with selling the bonds than in a best efforts offering.

10 In major developed bond markets, newly issued sovereign bonds are *most* often sold to the public via a(n):

A auction.

B private placement.

C best efforts offering.

11 Which of the following describes privately placed bonds?

A They are non-underwritten and unregistered.

B They usually have active secondary markets.

C They are less customized than publicly offered bonds.

12 A mechanism by which an issuer may be able to offer additional bonds to the general public without preparing a new and separate offering circular *best* describes:

A the grey market.

B a shelf registration.

C a private placement.

13 Which of the following statements related to secondary bond markets is *most accurate*?

A Newly issued corporate bonds are issued in secondary bond markets.

B Secondary bond markets are where bonds are traded between investors.

C The major participants in secondary bond markets globally are retail investors.

14 A bond market in which a communications network matches buy and sell orders initiated from various locations is *best* described as an:

A organized exchange.

B open market operation.

C over-the-counter market.

15 A liquid secondary bond market allows an investor to sell a bond at:

A the desired price.

B a price at least equal to the purchase price.

C a price close to the bond's fair market value.

16 Corporate bond secondary market trading *most often* occurs:

A on a book-entry basis.

B on organized exchanges.

C prior to settlement at $T + 1$.

17 Sovereign bonds are *best* described as:

A bonds issued by local governments.

B secured obligations of a national government.

C bonds backed by the taxing authority of a national government.

18 Which factor is associated with a more favorable quality sovereign bond credit rating?

A Issued in local currency, only

B Strong domestic savings base, only

C Issued in local currency of country with strong domestic savings base

19 Which type of sovereign bond has the lowest interest rate risk for an investor?

A Floaters

B Coupon bonds

C Discount bonds

20 Agency bonds are issued by:

A local governments.

B national governments.

C quasi-government entities.

21 The type of bond issued by a multilateral agency such as the International Monetary Fund (IMF) is *best* described as a:

A sovereign bond.

B supranational bond.

C quasi-government bond.

22 A bond issued by a local government authority, typically without an explicit funding commitment from the national government, is *most likely* classified as a:

A sovereign bond.

B quasi-government bond

C non-sovereign government bond.

23 Which of the following statements relating to commercial paper is *most accurate*?

A There is no secondary market for trading commercial paper.

B Only the strongest, highly rated companies issue commercial paper.

C Commercial paper is a source of interim financing for long-term projects.

24 Eurocommerical paper is *most likely*:

A negotiable.

B denominated in euro.

C issued on a discount basis.

25 For the issuer, a sinking fund arrangement is *most similar* to a:

A term maturity structure.

B serial maturity structure.

C bondholder put provision.

26 When issuing debt, a company may use a sinking fund arrangement as a means of reducing:

A credit risk.

B inflation risk.

C interest rate risk.

27 Which of the following is a source of wholesale funds for banks?

A Demand deposits

B Money market accounts

C Negotiable certificates of deposit

28 A characteristic of negotiable certificates of deposit is:

A they are mostly available in small denominations.

B they can be sold in the open market prior to maturity.

C a penalty is imposed if the depositor withdraws funds prior to maturity.

29 A repurchase agreement is *most* comparable to a(n):

A interbank deposit.

B collateralized loan.

C negotiable certificate of deposit.

30 The repo margin is:

A negotiated between counterparties.

B established independently of market-related conditions.

C structured on an agreement assuming equal credit risks to all counterparties.

31 The repo margin on a repurchase agreement is *most likely* to be lower when:

A the underlying collateral is in short supply.

B the maturity of the repurchase agreement is long.

C the credit risk associated with the underlying collateral is high.

SOLUTIONS

1 C is correct. In most countries, the largest issuers of bonds are the national and local governments as well as financial institutions. Thus, the bond market sector with the smallest amount of bonds outstanding is the non-financial corporate sector.

2 B is correct. The distinction between investment grade and non-investment grade debt relates to differences in credit quality, not tax status or maturity dates. Debt markets are classified based on the issuer's creditworthiness as judged by the credit ratings agencies. Ratings of Baa3 or above by Moody's Investors Service or BBB– or above by Standard & Poor's and Fitch Ratings are considered investment grade, whereas ratings below these levels are referred to as non-investment grade (also called high yield, speculative, or junk).

3 A is correct. Eurobonds are issued internationally, outside the jurisdiction of any single country. B is incorrect because foreign bonds are considered international bonds, but they are issued in a specific country, in the currency of that country, by an issuer domiciled in another country. C is incorrect because municipal bonds are US domestic bonds issued by a state or local government.

4 B is correct. Asset-backed securities (ABS) are securitized debt instruments created by securitization, a process that involves transferring ownership of assets from the original owners to a special legal entity. The special legal entity then issues securities backed by the transferred assets. The assets' cash flows are used to pay interest and repay the principal owed to the holders of the securities. Assets that are typically used to create securitized debt instruments include loans (such as mortgage loans) and receivables (such as credit card receivables). The structured finance sector includes such securitized debt instruments (also called asset-backed securities).

5 B is correct. Many emerging countries lag developed countries in the areas of political stability, property rights, and contract enforcement. Consequently, emerging market bonds usually exhibit higher risk than developed markets bonds. A is incorrect because emerging markets bonds typically offer higher (not lower) yields than developed markets bonds to compensate investors for the higher risk. C is incorrect because emerging markets bonds usually benefit from higher (not lower) growth prospects than developed markets bonds.

6 B is correct. The coupon rate of a floating-rate bond is expressed as a reference rate plus a spread. Different reference rates are used depending on where the bond is issued and its currency denomination, but one of the most widely used set of reference rates is Libor. A and C are incorrect because a bond's spread and frequency of coupon payments are typically set when the bond is issued and do not change during the bond's life.

7 A is correct. Changes in the coupon rate of interest on a floating-rate bond that uses a Libor reference rate are due to changes in the reference rate (for example, 90-day Libor), which resets periodically. "Therefore, the coupon rate adjusts to the level of market interest rates (plus the spread) each time the reference rate is reset."

8 C is correct. Interbank offered rates are used as reference rates not only for floating-rate bonds, but also for other debt instruments including mortgages, derivatives such as interest rate and currency swaps, and many other financial contracts and products. A and B are incorrect because an interbank offered rate such as Libor or Euribor is a set of reference rates (not a single reference rate) for different borrowing periods of up to one year (not 10 years).

9 A is correct. In an underwritten offering (also called firm commitment offering), the investment bank (called the underwriter) guarantees the sale of the bond issue at an offering price that is negotiated with the issuer. Thus, the underwriter takes the risk of buying the newly issued bonds from the issuer, and then reselling them to investors or to dealers who then sell them to investors. B and C are incorrect because the bond issuing mechanism where an investment bank acts as a broker and receives a commission for selling the bonds to investors, and incurs less risk associated with selling the bonds, is a best efforts offering (not an underwritten offering).

10 A is correct. In major developed bond markets, newly issued sovereign bonds are sold to the public via an auction. B and C are incorrect because sovereign bonds are rarely issued via private placements or best effort offerings.

11 A is correct. Private placements are typically non-underwritten, unregistered bond offerings that are sold only to a single investor or a small group of investors.

12 B is correct. A shelf registration allows certain authorized issuers to offer additional bonds to the general public without having to prepare a new and separate offering circular. The issuer can offer multiple bond issuances under the same master prospectus, and only has to prepare a short document when additional bonds are issued. A is incorrect because the grey market is a forward market for bonds about to be issued. C is incorrect because a private placement is a non-underwritten, unregistered offering of bonds that are not sold to the general public but directly to an investor or a small group of investors.

13 B is correct. Secondary bond markets are where bonds are traded between investors. A is incorrect because newly issued bonds (whether from corporate issuers or other types of issuers) are issued in primary (not secondary) bond markets. C is incorrect because the major participants in secondary bond markets globally are large institutional investors and central banks (not retail investors).

14 C is correct. In over-the-counter (OTC) markets, buy and sell orders are initiated from various locations and then matched through a communications network. Most bonds are traded in OTC markets. A is incorrect because on organized exchanges, buy and sell orders may come from anywhere, but the transactions must take place at the exchange according to the rules imposed by the exchange. B is incorrect because open market operations refer to central bank activities in secondary bond markets. Central banks buy and sell bonds, usually sovereign bonds issued by the national government, as a means to implement monetary policy.

15 C is correct. Liquidity in secondary bond markets refers to the ability to buy or sell bonds quickly at prices close to their fair market value. A and B are incorrect because a liquid secondary bond market does not guarantee that a bond will sell at the price sought by the investor, or that the investor will not face a loss on his or her investment.

16 A is correct. The vast majority of corporate bonds are traded in over-the-counter (OTC) markets that use electronic trading platforms through which users submit buy and sell orders. Settlement of trades in the OTC markets occurs by means of a simultaneous exchange of bonds for cash on the books of the clearing system "on a paperless, computerized book-entry basis."

17 C is correct. Sovereign bonds are usually unsecured obligations of the national government issuing the bonds; they are not backed by collateral, but by the taxing authority of the national government. A is incorrect because bonds issued

by local governments are non-sovereign (not sovereign) bonds. B is incorrect because sovereign bonds are typically unsecured (not secured) obligations of a national government.

18 C is correct. Bonds issued in the sovereign's currency and a strong domestic savings base are both favorable sovereign rating factors. It is common to observe a higher credit rating for sovereign bonds issued in local currency because of the sovereign's ability to tax its citizens and print its own currency. Although there are practical limits to the sovereign's taxing and currency-printing capacities, each tends to support a sovereign's ability to repay debt. A strong domestic savings base is advantageous because it supports the sovereign's ability to issue debt in local currency to domestic investors.

19 A is correct. Floaters are bonds with a floating rate of interest that resets periodically based on changes in the level of a reference rate, such as Libor. Because changes in the reference rate reflect changes in market interest rates, price changes of floaters are far less pronounced than those of fixed-rate bonds, such as coupon bonds and discount bonds. Thus, investors holding floaters are less exposed to interest rate risk than investors holding fixed-rate discount or coupon bonds.

20 C is correct. Agency bonds are issued by quasi-government entities. These entities are agencies and organizations usually established by national governments to perform various functions for them. A and B are incorrect because local and national governments issue non-sovereign and sovereign bonds, respectively.

21 B is correct. The IMF is a multilateral agency that issues supranational bonds. A and C are incorrect because sovereign bonds and quasi-government bonds are issued by national governments and by entities that perform various functions for national governments, respectively.

22 C is correct. Bonds issued by levels of government below the national level—such as provinces, regions, states, cities, and local government authorities—are classified as non-sovereign government bonds. These bonds are typically not guaranteed by the national government.

23 C is correct. Companies use commercial paper not only as a source of funding working capital and seasonal demand for cash, but also as a source of interim financing for long-term projects until permanent financing can be arranged. A is incorrect because there is a secondary market for trading commercial paper, although trading is limited except for the largest issues. B is incorrect because commercial paper is issued by companies across the risk spectrum, although only the strongest, highly rated companies issue *low-cost* commercial paper.

24 A is correct. Commercial paper, whether US commercial paper or Eurocommercial paper, is negotiable—that is, investors can buy and sell commercial paper on secondary markets. B is incorrect because Eurocommercial paper can be denominated in any currency. C is incorrect because Eurocommercial paper may be issued on an interest-bearing (or yield) basis or a discount basis.

25 B is correct. With a serial maturity structure, a stated number of bonds mature and are paid off on a pre-determined schedule before final maturity. With a sinking fund arrangement, the issuer is required to set aside funds over time to retire the bond issue. Both result in a pre-determined portion of the issue being paid off according to a pre-determined schedule.

26 A is correct. A sinking fund arrangement is a way to reduce credit risk by making the issuer set aside funds over time to retire the bond issue. B and C are incorrect because a sinking fund arrangement has no effect on inflation risk or interest rate risk.

27 C is correct. Wholesale funds available for banks include central bank funds, interbank funds, and negotiable certificates of deposit. A and B are incorrect because demand deposits (also known as checking accounts) and money market accounts are retail deposits (not wholesale funds).

28 B is correct. A negotiable certificate of deposit (CD) allows any depositor (initial or subsequent) to sell the CD in the open market prior to maturity. A is incorrect because negotiable CDs are mostly available in large (not small) denominations. Large-denomination negotiable CDs are an important source of wholesale funds for banks, whereas small-denomination CDs are not. C is incorrect because a penalty is imposed if the depositor withdraws funds prior to maturity for non-negotiable (instead of negotiable) CDs.

29 B is correct. A repurchase agreement (repo) can be viewed as a collateralized loan where the security sold and subsequently repurchased represents the collateral posted. A and C are incorrect because interbank deposits and negotiable certificates of deposit are unsecured deposits—that is, there is no collateral backing the deposit.

30 A is correct. Repo margins vary by transaction and are negotiated bilaterally between the counterparties.

31 A is correct. The repo margin (the difference between the market value of the underlying collateral and the value of the loan) is a function of the supply and demand conditions of the collateral. The repo margin is typically lower if the underlying collateral is in short supply or if there is a high demand for it. B and C are incorrect because the repo margin is usually higher (not lower) when the maturity of the repurchase agreement is long and when the credit risk associated with the underlying collateral is high.

PRACTICE PROBLEMS

1 A portfolio manager is considering the purchase of a bond with a 5.5% coupon rate that pays interest annually and matures in three years. If the required rate of return on the bond is 5%, the price of the bond per 100 of par value is *closest* to:

A 98.65.

B 101.36.

C 106.43.

2 A bond with two years remaining until maturity offers a 3% coupon rate with interest paid annually. At a market discount rate of 4%, the price of this bond per 100 of par value is *closest* to:

A 95.34.

B 98.00.

C 98.11.

3 An investor who owns a bond with a 9% coupon rate that pays interest semiannually and matures in three years is considering its sale. If the required rate of return on the bond is 11%, the price of the bond per 100 of par value is *closest* to:

A 95.00.

B 95.11.

C 105.15.

4 A bond offers an annual coupon rate of 4%, with interest paid semiannually. The bond matures in two years. At a market discount rate of 6%, the price of this bond per 100 of par value is *closest* to:

A 93.07.

B 96.28.

C 96.33.

5 A bond offers an annual coupon rate of 5%, with interest paid semiannually. The bond matures in seven years. At a market discount rate of 3%, the price of this bond per 100 of par value is *closest* to:

A 106.60.

B 112.54.

C 143.90.

6 A zero-coupon bond matures in 15 years. At a market discount rate of 4.5% per year and assuming annual compounding, the price of the bond per 100 of par value is *closest* to:

A 51.30.

B 51.67.

C 71.62.

7 Consider the following two bonds that pay interest annually:

Bond	Coupon Rate	Time-to-Maturity
A	5%	2 years
B	3%	2 years

At a market discount rate of 4%, the price difference between Bond A and Bond B per 100 of par value is *closest* to:

A 3.70.

B 3.77.

C 4.00.

The following information relates to Questions 8 and 9

Bond	Price	Coupon Rate	Time-to-Maturity
A	101.886	5%	2 years
B	100.000	6%	2 years
C	97.327	5%	3 years

8 Which bond offers the lowest yield-to-maturity?

A Bond A

B Bond B

C Bond C

9 Which bond will *most likely* experience the smallest percent change in price if the market discount rates for all three bonds increase by 100 basis points?

A Bond A

B Bond B

C Bond C

---

10 Suppose a bond's price is expected to increase by 5% if its market discount rate decreases by 100 basis points. If the bond's market discount rate increases by 100 basis points, the bond price is *most likely* to change by:

A 5%.

B less than 5%.

C more than 5%.

The following information relates to Questions 11 and 12

Bond	Coupon Rate	Maturity (years)
A	6%	10
B	6%	5
C	8%	5

All three bonds are currently trading at par value.

11 Relative to Bond C, for a 200 basis point decrease in the required rate of return, Bond B will *most likely* exhibit a(n):

A equal percentage price change.

B greater percentage price change.

C smaller percentage price change.

12 Which bond will *most likely* experience the greatest percentage change in price if the market discount rates for all three bonds increase by 100 basis points?

A Bond A

B Bond B

C Bond C

---

13 An investor considers the purchase of a 2-year bond with a 5% coupon rate, with interest paid annually. Assuming the sequence of spot rates shown below, the price of the bond is *closest* to:

Time-to-Maturity	Spot Rates
1 year	3%
2 years	4%

A 101.93.

B 102.85.

C 105.81.

14 A 3-year bond offers a 10% coupon rate with interest paid annually. Assuming the following sequence of spot rates, the price of the bond is *closest* to:

Time-to-Maturity	Spot Rates
1 year	8.0%
2 years	9.0%
3 years	9.5%

A 96.98.

B 101.46.

C 102.95.

The following information relates to Questions 15–17

Bond	Coupon Rate	Time-to-Maturity	Time-to-Maturity	Spot Rates
X	8%	3 years	1 year	8%
Y	7%	3 years	2 years	9%
Z	6%	3 years	3 years	10%

All three bonds pay interest annually.

15 Based upon the given sequence of spot rates, the price of Bond X is *closest* to:

A 95.02.

B 95.28.

C 97.63.

16 Based upon the given sequence of spot rates, the price of Bond Y is *closest* to:

A 87.50.

B 92.54.

C 92.76.

17 Based upon the given sequence of spot rates, the yield-to-maturity of Bond Z is *closest* to:

A 9.00%.

B 9.92%.

C 11.93%

---

18 Bond dealers *most* often quote the:

A flat price.

B full price.

C full price plus accrued interest.

The following information relates to Questions 19–21

Bond G, described in the exhibit below, is sold for settlement on 16 June 2020.

Annual Coupon	5%
Coupon Payment Frequency	Semiannual
Interest Payment Dates	10 April and 10 October
Maturity Date	10 October 2022
Day Count Convention	30/360
Annual Yield-to-Maturity	4%

19 The full price that Bond G settles at on 16 June 2020 is *closest* to:

A 102.36.

B 103.10.

C 103.65.

20 The accrued interest per 100 of par value for Bond G on the settlement date of 16 June 2020 is *closest* to:

A 0.46.

B 0.73.

C 0.92.

21 The flat price for Bond G on the settlement date of 16 June 2020 is *closest* to:

A 102.18.

B 103.10.

C 104.02.

---

22 Matrix pricing allows investors to estimate market discount rates and prices for bonds:

A with different coupon rates.

B that are not actively traded.

C with different credit quality.

23 When underwriting new corporate bonds, matrix pricing is used to get an estimate of the:

A required yield spread over the benchmark rate.

B market discount rate of other comparable corporate bonds.

C yield-to-maturity on a government bond having a similar time-to-maturity.

24 A bond with 20 years remaining until maturity is currently trading for 111 per 100 of par value. The bond offers a 5% coupon rate with interest paid semiannually. The bond's annual yield-to-maturity is *closest* to:

A 2.09%.

B 4.18%.

C 4.50%.

25 The annual yield-to-maturity, stated for with a periodicity of 12, for a 4-year, zero-coupon bond priced at 75 per 100 of par value is *closest* to:

A 6.25%.

B 7.21%.

C 7.46%.

26 A 5-year, 5% semiannual coupon payment corporate bond is priced at 104.967 per 100 of par value. The bond's yield-to-maturity, quoted on a semiannual bond basis, is 3.897%. An analyst has been asked to convert to a monthly periodicity. Under this conversion, the yield-to-maturity is *closest to*:

A 3.87%.

B 4.95%.

C 7.67%.

The following information relates to Questions 27–30

A bond with 5 years remaining until maturity is currently trading for 101 per 100 of par value. The bond offers a 6% coupon rate with interest paid semiannually. The bond is first callable in 3 years, and is callable after that date on coupon dates according to the following schedule:

End of Year	Call Price
3	102
4	101
5	100

27 The bond's annual yield-to-maturity is *closest* to:

A 2.88%.

B 5.77%.

C 5.94%.

28 The bond's annual yield-to-first-call is *closest* to:

A 3.12%.

B 6.11%.

C 6.25%.

29 The bond's annual yield-to-second-call is *closest* to:

A 2.97%.

B 5.72%.

C 5.94%.

30 The bond's yield-to-worst is *closest* to:

A 2.88%.

B 5.77%.

C 6.25%.

---

31 A two-year floating-rate note pays 6-month Libor plus 80 basis points. The floater is priced at 97 per 100 of par value. Current 6-month Libor is 1.00%. Assume a 30/360 day-count convention and evenly spaced periods. The discount margin for the floater in basis points (bps) is *closest* to:

A 180 bps.

B 236 bps.

C 420 bps.

32 An analyst evaluates the following information relating to floating rate notes (FRNs) issued at par value that have 3-month Libor as a reference rate:

Floating Rate Note	Quoted Margin	Discount Margin
X	0.40%	0.32%
Y	0.45%	0.45%
Z	0.55%	0.72%

Based only on the information provided, the FRN that will be priced at a premium on the next reset date is:

A FRN X.

B FRN Y.

C FRN Z.

33 A 365-day year bank certificate of deposit has an initial principal amount of USD 96.5 million and a redemption amount due at maturity of USD 100 million. The number of days between settlement and maturity is 350. The bond equivalent yield is *closest* to:

A 3.48%.

B 3.65%.

C 3.78%.

34 The bond equivalent yield of a 180-day banker's acceptance quoted at a discount rate of 4.25% for a 360-day year is *closest* to:

A 4.31%.

B 4.34%.

C 4.40%.

35 Which of the following statements describing a par curve is *incorrect*?

A A par curve is obtained from a spot curve.

B All bonds on a par curve are assumed to have different credit risk.

C A par curve is a sequence of yields-to-maturity such that each bond is priced at par value.

36 A yield curve constructed from a sequence of yields-to-maturity on zero-coupon bonds is the:

A par curve.

B spot curve.

C forward curve.

37 The rate, interpreted to be the incremental return for extending the time-to-maturity of an investment for an additional time period, is the:

A add-on rate.

B forward rate.

C yield-to-maturity.

The following information relates to Questions 38 and 39

Time Period	Forward Rate
"0y1y"	0.80%
"1y1y"	1.12%
"2y1y"	3.94%
"3y1y"	3.28%
"4y1y"	3.14%

All rates are annual rates stated for a periodicity of one (effective annual rates).

38 The 3-year implied spot rate is *closest* to:

- **A** 1.18%.
- **B** 1.94%.
- **C** 2.28%.

39 The value per 100 of par value of a two-year, 3.5% coupon bond, with interest payments paid annually, is *closest* to:

- **A** 101.58.
- **B** 105.01.
- **C** 105.82.

---

40 The spread component of a specific bond's yield-to-maturity is *least likely* impacted by changes in:

- **A** its tax status.
- **B** its quality rating.
- **C** inflation in its currency of denomination.

41 The yield spread of a specific bond over the standard swap rate in that currency of the same tenor is *best* described as the:

- **A** I-spread.
- **B** Z-spread.
- **C** G-spread.

The following information relates to Question 42

Bond	Coupon Rate	Time-to-Maturity	Price
UK Government Benchmark Bond	2%	3 years	100.25
UK Corporate Bond	5%	3 years	100.65

Both bonds pay interest annually. The current three-year EUR interest rate swap benchmark is 2.12%.

42 The G-spread in basis points (bps) on the UK corporate bond is *closest* to:

- **A** 264 bps.
- **B** 285 bps.
- **C** 300 bps.

---

43 A corporate bond offers a 5% coupon rate and has exactly 3 years remaining to maturity. Interest is paid annually. The following rates are from the benchmark spot curve:

Time-to-Maturity	Spot Rate
1 year	4.86%
2 years	4.95%
3 years	5.65%

The bond is currently trading at a Z-spread of 234 basis points. The value of the bond is *closest to*:

A 92.38.

B 98.35.

C 106.56.

44 An option-adjusted spread (OAS) on a callable bond is the Z-spread:

A over the benchmark spot curve.

B minus the standard swap rate in that currency of the same tenor.

C minus the value of the embedded call option expressed in basis points per year.

SOLUTIONS

1 B is correct. The bond price is closest to 101.36. The price is determined in the following manner:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT + FV}{(1+r)^3}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$PV = \frac{5.5}{(1+0.05)^1} + \frac{5.5}{(1+0.05)^2} + \frac{5.5+100}{(1+0.05)^3}$$

PV = 5.24 + 4.99 + 91.13 = 101.36

2 C is correct. The bond price is closest to 98.11. The formula for calculating the price of this bond is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT + FV}{(1+r)^2}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$PV = \frac{3}{(1+0.04)^1} + \frac{3+100}{(1+0.04)^2} = 2.88 + 95.23 = 98.11$$

3 A is correct. The bond price is closest to 95.00. The bond has six semiannual periods. Half of the annual coupon is paid in each period with the required rate of return also being halved. The price is determined in the following manner:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \frac{PMT}{(1+r)^4} + \frac{PMT}{(1+r)^5} + \frac{PMT + FV}{(1+r)^6}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$PV = \frac{4.5}{(1+0.055)^1} + \frac{4.5}{(1+0.055)^2} + \frac{4.5}{(1+0.055)^3} + \frac{4.5}{(1+0.055)^4} + \frac{4.5}{(1+0.055)^5} + \frac{4.5+100}{(1+0.055)^6}$$

$PV = 4.27 + 4.04 + 3.83 + 3.63 + 3.44 + 75.79 = 95.00$

4 B is correct. The bond price is closest to 96.28. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \frac{PMT+FV}{(1+r)^4}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$PV = \frac{2}{(1+0.03)^1} + \frac{2}{(1+0.03)^2} + \frac{2}{(1+0.03)^3} + \frac{2+100}{(1+0.03)^4}$$

$PV = 1.94 + 1.89 + 1.83 + 90.62 = 96.28$

5 B is correct. The bond price is closest to 112.54. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT+FV}{(1+r)^{14}}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$PV = \frac{2.5}{(1+0.015)^1} + \frac{2.5}{(1+0.015)^2} + \frac{2.5}{(1+0.015)^3} + \cdots + \frac{2.5}{(1+0.015)^{13}} + \frac{2.5+100}{(1+0.015)^{14}}$$

$PV = 2.46 + 2.43 + 2.39 + \ldots + 2.06 + 83.21 = 112.54$

6 B is correct. The price of the zero-coupon bond is closest to 51.67. The price is determined in the following manner:

$$PV = \frac{100}{(1+r)^N}$$

where:

PV = present value, or the price of the bond
r = market discount rate, or required rate of return per period
N = number of evenly spaced periods to maturity

$$PV = \frac{100}{(1 + 0.045)^{15}}$$

$$PV = 51.67$$

7 B is correct. The price difference between Bonds A and B is closest to 3.77. One method for calculating the price difference between two bonds with an identical term to maturity is to use the following formula:

$$PV = \frac{PMT}{(1 + r)^1} + \frac{PMT}{(1 + r)^2}$$

where:

PV = price difference
PMT = coupon difference per period
r = market discount rate, or required rate of return per period

In this case the coupon difference is (5% – 3%), or 2%.

$$PV = \frac{2}{(1 + 0.04)^1} + \frac{2}{(1 + 0.04)^2} = 1.92 + 1.85 = 3.77$$

8 A is correct. Bond A offers the lowest yield-to-maturity. When a bond is priced at a premium above par value the yield-to-maturity (YTM), or market discount rate is less than the coupon rate. Bond A is priced at a premium, so its YTM is below its 5% coupon rate. Bond B is priced at par value so its YTM is equal to its 6% coupon rate. Bond C is priced at a discount below par value, so its YTM is above its 5% coupon rate.

9 B is correct. Bond B will most likely experience the smallest percent change in price if market discount rates increase by 100 basis points. A higher-coupon bond has a smaller percentage price change than a lower-coupon bond when their market discount rates change by the same amount (the coupon effect). Also, a shorter-term bond generally has a smaller percentage price change than a longer-term bond when their market discount rates change by the same amount (the maturity effect). Bond B will experience a smaller percent change in price than Bond A because of the coupon effect. Bond B will also experience a smaller percent change in price than Bond C because of the coupon effect and the maturity effect.

10 B is correct. The bond price is most likely to change by less than 5%. The relationship between bond prices and market discount rate is not linear. The percentage price change is greater in absolute value when the market discount rate goes down than when it goes up by the same amount (the convexity effect). If a 100 basis point decrease in the market discount rate will cause the price of the bond to increase by 5%, then a 100 basis point increase in the market discount rate will cause the price of the bond to decline by an amount less than 5%.

11 B is correct. Generally, for two bonds with the same time-to-maturity, a lower coupon bond will experience a greater percentage price change than a higher coupon bond when their market discount rates change by the same amount. Bond B and Bond C have the same time-to-maturity (5 years); however, Bond B offers a lower coupon rate. Therefore, Bond B will likely experience a greater percentage change in price in comparison to Bond C.

12 A is correct. Bond A will likely experience the greatest percent change in price due to the coupon effect and the maturity effect. For two bonds with the same time-to-maturity, a lower-coupon bond has a greater percentage price change than a higher-coupon bond when their market discount rates change by the same amount. Generally, for the same coupon rate, a longer-term bond has a greater percentage price change than a shorter-term bond when their market discount rates change by the same amount. Relative to Bond C, Bond A and Bond B both offer the same lower coupon rate of 6%; however, Bond A has a longer time-to-maturity than Bond B. Therefore, Bond A will likely experience the greater percentage change in price if the market discount rates for all three bonds increase by 100 basis points.

13 A is correct. The bond price is closest to 101.93. The price is determined in the following manner:

$$PV = \frac{PMT}{(1+Z_1)^1} + \frac{PMT + FV}{(1+Z_2)^2}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
Z_1 = spot rate, or the zero-coupon yield, for Period 1
Z_2 = spot rate, or the zero-coupon yield, for Period 2

$$PV = \frac{5}{(1+0.03)^1} + \frac{5+100}{(1+0.04)^2}$$

PV = 4.85 + 97.08 = 101.93

14 B is correct. The bond price is closest to 101.46. The price is determined in the following manner:

$$PV = \frac{PMT}{(1+Z_1)^1} + \frac{PMT}{(1+Z_2)^2} + \frac{PMT + FV}{(1+Z_3)^3}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
Z_1 = spot rate, or the zero-coupon yield, or zero rate, for period 1
Z_2 = spot rate, or the zero-coupon yield, or zero rate, for period 2
Z_3 = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{10}{(1+0.08)^1} + \frac{10}{(1+0.09)^2} + \frac{10+100}{(1+0.095)^3}$$

PV = 9.26 + 8.42 + 83.78 = 101.46

15 B is correct. The bond price is closest to 95.28. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1+Z_1)^1} + \frac{PMT}{(1+Z_2)^2} + \frac{PMT+FV}{(1+Z_3)^3}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
Z_1 = spot rate, or the zero-coupon yield, or zero rate, for period 1
Z_2 = spot rate, or the zero-coupon yield, or zero rate, for period 2
Z_3 = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{8}{(1+0.08)^1} + \frac{8}{(1+0.09)^2} + \frac{8+100}{(1+0.10)^3}$$

$PV = 7.41 + 6.73 + 81.14 = 95.28$

16 C is correct. The bond price is closest to 92.76. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1+Z_1)^1} + \frac{PMT}{(1+Z_2)^2} + \frac{PMT+FV}{(1+Z_3)^3}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
Z_1 = spot rate, or the zero-coupon yield, or zero rate, for period 1
Z_2 = spot rate, or the zero-coupon yield, or zero rate, for period 2
Z_3 = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{7}{(1+0.08)^1} + \frac{7}{(1+0.09)^2} + \frac{7+100}{(1+0.10)^3}$$

$PV = 6.48 + 5.89 + 80.39 = 92.76$

17 B is correct. The yield-to-maturity is closest to 9.92%. The formula for calculating the price of Bond Z is:

$$PV = \frac{PMT}{(1+Z_1)^1} + \frac{PMT}{(1+Z_2)^2} + \frac{PMT+FV}{(1+Z_3)^3}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
Z_1 = spot rate, or the zero-coupon yield, or zero rate, for period 1
Z_2 = spot rate, or the zero-coupon yield, or zero rate, for period 2
Z_3 = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{6}{(1+0.08)^1} + \frac{6}{(1+0.09)^2} + \frac{6+100}{(1+0.10)^3}$$

$PV = 5.56 + 5.05 + 79.64 = 90.25$

Using this price, the bond's yield-to-maturity can be calculated as:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT + FV}{(1+r)^3}$$

$$90.25 = \frac{6}{(1+r)^1} + \frac{6}{(1+r)^2} + \frac{6+100}{(1+r)^3}$$

$r = 9.92\%$

18 A is correct. Bond dealers usually quote the flat price. When a trade takes place, the accrued interest is added to the flat price to obtain the full price paid by the buyer and received by the seller on the settlement date. The reason for using the flat price for quotation is to avoid misleading investors about the market price trend for the bond. If the full price were to be quoted by dealers, investors would see the price rise day after day even if the yield-to-maturity did not change. That is because the amount of accrued interest increases each day. Then after the coupon payment is made the quoted price would drop dramatically. Using the flat price for quotation avoids that misrepresentation. The full price, flat price plus accrued interest, is not usually quoted by bond dealers. Accrued interest is included in not added to the full price and bond dealers do not generally quote the full price.

19 B is correct. The bond's full price is 103.10. The price is determined in the following manner:

As of the beginning of the coupon period on 10 April 2020, there are 2.5 years (5 semiannual periods) to maturity. These five semiannual periods occur on 10 October 2020, 10 April 2021, 10 October 2021, 10 April 2022 and 10 October 2022.

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \frac{PMT}{(1+r)^4} + \frac{PMT + FV}{(1+r)^5}$$

where:

PV = present value
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$PV = \frac{2.5}{(1+0.02)^1} + \frac{2.5}{(1+0.02)^2} + \frac{2.5}{(1+0.02)^3} + \frac{2.5}{(1+0.02)^4} + \frac{2.5+100}{(1+0.02)^5}$$

$PV = 2.45 + 2.40 + 2.36 + 2.31 + 92.84 = 102.36$

The accrued interest period is identified as 66/180. The number of days between 10 April 2020 and 16 June 2020 is 66 days based on the 30/360 day count convention. (This is 20 days remaining in April + 30 days in May + 16 days in June = 66 days total). The number of days between coupon periods is assumed to be 180 days using the 30/360 day convention.

$$PV^{Full} = PV \times (1 + r)^{66/180}$$

$$PV^{Full} = 102.36 \times (1.02)^{66/180} = 103.10$$

20 C is correct. The accrued interest per 100 of par value is closest to 0.92. The accrued interest is determined in the following manner: The accrued interest period is identified as 66/180. The number of days between 10 April 2020 and 16 June 2020 is 66 days based on the 30/360 day count convention. (This is 20 days remaining in April + 30 days in May + 16 days in June = 66 days total). The number of days between coupon periods is assumed to be 180 days using the 30/360 day convention.

$$\text{Accrued interest} = \frac{t}{T} \times PMT$$

where:

t = number of days from the last coupon payment to the settlement date
T = number of days in the coupon period
t/T = fraction of the coupon period that has gone by since the last payment
PMT = coupon payment per period

$$\text{Accrued interest} = \frac{66}{180} \times \frac{5.00}{2} = 0.92$$

21 A is correct. The flat price of 102.18 is determined by subtracting the accrued interest (from question 20) from the full price (from question 19).

$$PV^{Flat} = PV^{Full} - \text{Accrued Interest}$$

$$PV^{Flat} = 103.10 - 0.92 = 102.18$$

22 B is correct. For bonds not actively traded or not yet issued, matrix pricing is a price estimation process that uses market discount rates based on the quoted prices of similar bonds (similar times-to-maturity, coupon rates, and credit quality).

23 A is correct. Matrix pricing is used in underwriting new bonds to get an estimate of the required yield spread over the benchmark rate. The benchmark rate is typically the yield-to-maturity on a government bond having the same, or close to the same, time-to-maturity. The spread is the difference between the yield-to-maturity on the new bond and the benchmark rate. The yield spread is the additional compensation required by investors for the difference in the credit risk, liquidity risk, and tax status of the bond relative to the government bond.

In matrix pricing, the market discount rates of comparable bonds and the yield-to-maturity on a government bond having a similar time-to-maturity are not estimated. Rather they are known and used to estimate the required yield spread of a new bond.

24 B is correct. The formula for calculating this bond's yield-to-maturity is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^{39}} + \frac{PMT + FV}{(1+r)^{40}}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$111 = \frac{2.5}{(1+r)^1} + \frac{2.5}{(1+r)^2} + \frac{2.5}{(1+r)^3} + \cdots + \frac{2.5}{(1+r)^{39}} + \frac{2.5 + 100}{(1+r)^{40}}$$

$r = 0.0209$

To arrive at the annualized yield-to-maturity, the semiannual rate of 2.09% must be multiplied by two. Therefore, the yield-to-maturity is equal to 2.09% × 2 = 4.18%.

25 B is correct. The annual yield-to-maturity, stated for a periodicity of 12, is 7.21%. It is calculated as follows:

$$PV = \frac{FV}{(1+r)^N}$$

$$75 = \left(\frac{100}{(1+r)^{4\times 12}}\right)$$

$$\frac{100}{75} = (1+r)^{48}$$

$1.33333 = (1 + r)^{48}$

$[1.33333]^{1/48} = [(1 + r)^{48}]^{1/48}$

$1.33333^{02083} = (1 + r)$

$1.00601 = (1 + r)$

$1.00601 - 1 = r$

$0.00601 = r$

$r \times 12 = 0.07212$, or approximately 7.21%

26 A is correct. The yield-to-maturity, stated for a periodicity of 12 (monthly periodicity), is 3.87%. The formula to convert an annual percentage rate (annual yield-to-maturity) from one periodicity to another is as follows:

$$\left(1 + \frac{APR_m}{m}\right)^m = \left(1 + \frac{APR_n}{n}\right)^n$$

$$\left(1 + \frac{0.03897}{2}\right)^2 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$(1.01949)^2 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$1.03935 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$(1.03935)^{1/12} = \left[\left(1 + \frac{APR_{12}}{12}\right)^{12}\right]^{1/12}$$

$$1.00322 = \left(1 + \frac{APR_{12}}{12}\right)$$

$$1.00322 - 1 = \left(\frac{APR_{12}}{12}\right)$$

APR_{12} = 0.00322 × 12 = 0.03865, or approximately 3.87%.

27 B is correct. The yield-to-maturity is 5.77%. The formula for calculating this bond's yield-to-maturity is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^9} + \frac{PMT + FV}{(1+r)^{10}}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = future value paid at maturity, or the par value of the bond
r = market discount rate, or required rate of return per period

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \cdots + \frac{3}{(1+r)^9} + \frac{3+100}{(1+r)^{10}}$$

r = 0.02883

To arrive at the annualized yield-to-maturity, the semiannual rate of 2.883% must be multiplied by two. Therefore, the yield-to-maturity is equal to 2.883% × 2 = 5.77% (rounded).

28 C is correct. The yield-to-first-call is 6.25%. Given the first call date is exactly three years away, the formula for calculating this bond's yield-to-first-call is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^5} + \frac{PMT + FV}{(1+r)^6}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = call price paid at call date
r = market discount rate, or required rate of return per period

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \cdots + \frac{3}{(1+r)^5} + \frac{3+102}{(1+r)^6}$$

$r = 0.03123$

To arrive at the annualized yield-to-first-call, the semiannual rate of 3.123% must be multiplied by two. Therefore, the yield-to-first-call is equal to 3.123% × 2 = 6.25% (rounded).

29 C is correct. The yield-to-second-call is 5.94%. Given the second call date is exactly four years away, the formula for calculating this bond's yield-to-second-call is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^7} + \frac{PMT + FV}{(1+r)^8}$$

where:

PV = present value, or the price of the bond
PMT = coupon payment per period
FV = call price paid at call date
r = market discount rate, or required rate of return per period

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \cdots \frac{3}{(1+r)^7} + \frac{3+101}{(1+r)^8}$$

$r = 0.0297$

To arrive at the annualized yield-to-second-call, the semiannual rate of 2.97% must be multiplied by two. Therefore, the yield-to-second-call is equal to 2.97% × 2 = 5.94%.

30 B is correct. The yield-to-worst is 5.77%. The bond's yield-to-worst is the lowest of the sequence of yields-to-call and the yield-to-maturity. From above, we have the following yield measures for this bond:

Yield-to-first-call: 6.25%

Yield-to-second-call: 5.94%

Yield-to-maturity: 5.77%

Thus, the yield-to-worst is 5.77%.

31 B is correct. The discount or required margin is 236 basis points. Given the floater has a maturity of two years and is linked to 6-month Libor, the formula for calculating discount margin is:

$$PV = \frac{\frac{(\text{Index} + QM) \times FV}{m}}{\left(1 + \frac{\text{Index} + DM}{m}\right)^1} + \frac{\frac{(\text{Index} + QM) \times FV}{m}}{\left(1 + \frac{\text{Index} + DM}{m}\right)^2} + \cdots + \frac{\frac{(\text{Index} + QM) \times FV}{m} + FV}{\left(1 + \frac{\text{Index} + DM}{m}\right)^4}$$

where:

PV = present value, or the price of the floating-rate note = 97
Index = reference rate, stated as an annual percentage rate = 0.01
QM = quoted margin, stated as an annual percentage rate = 0.0080

FV = future value paid at maturity, or the par value of the bond = 100
m = periodicity of the floating-rate note, the number of payment periods per year = 2
DM = discount margin, the required margin stated as an annual percentage rate

Substituting given values in:

$$97 = \frac{\frac{(0.01 + 0.0080) \times 100}{2}}{\left(1 + \frac{0.01 + DM}{2}\right)^1} + \frac{\frac{(0.01 + 0.0080) \times 100}{2}}{\left(1 + \frac{0.01 + DM}{2}\right)^2} + \cdots + \frac{\frac{(0.01 + 0.0080) \times 100}{2} + 100}{\left(1 + \frac{0.01 + DM}{2}\right)^4}$$

$$97 = \frac{0.90}{\left(1 + \frac{0.01 + DM}{2}\right)^1} + \frac{0.90}{\left(1 + \frac{0.01 + DM}{2}\right)^2} + \frac{0.90}{\left(1 + \frac{0.01 + DM}{2}\right)^3} + \frac{0.90 + 100}{\left(1 + \frac{0.01 + DM}{2}\right)^4}$$

To calculate DM, begin by solving for the discount rate per period:

$$97 = \frac{0.90}{(1 + r)^1} + \frac{0.90}{(1 + r)^2} + \frac{0.90}{(1 + r)^3} + \frac{0.90 + 100}{(1 + r)^4}$$

$r = 0.0168$

Now, solve for DM:

$$\frac{0.01 + DM}{2} = 0.0168$$

$DM = 0.0236$

The discount margin for the floater is equal to 236 basis points.

32 A is correct. FRN X will be priced at a premium on the next reset date because the quoted margin of 0.40% is greater than the discount or required margin of 0.32%. The premium amount is the present value of the extra or "excess" interest payments of 0.08% each quarter (0.40% – 0.32%). FRN Y will be priced at par value on the next reset date since there is no difference between the quoted and discount margins. FRN Z will be priced at a discount since the quoted margin is less than the required margin.

33 C is correct. The bond equivalent yield is closest to 3.78%. It is calculated as:

$$AOR = \left(\frac{\text{Year}}{\text{Days}}\right) \times \left(\frac{FV - PV}{PV}\right)$$

where:

PV = present value, principal amount, or the price of the money market instrument
FV = future value, or the redemption amount paid at maturity including interest
Days = number of days between settlement and maturity
Year = number of days in the year
AOR = add-on rate, stated as an annual percentage rate (also, called bond equivalent yield).

$$AOR = \left(\frac{365}{350}\right) \times \left(\frac{100 - 96.5}{96.5}\right)$$

$AOR = 1.04286 \times 0.03627$

$AOR = 0.03783$ or approximately 3.78%

34 C is correct. The bond equivalent yield is closest to 4.40%. The present value of the banker's acceptance is calculated as:

$$PV = FV \times \left(1 - \frac{\text{Days}}{\text{Year}} \times DR\right)$$

where:

PV = present value, or price of the money market instrument
FV = future value paid at maturity, or face value of the money market instrument
Days = number of days between settlement and maturity
Year = number of days in the year
DR = discount rate, stated as an annual percentage rate

$$PV = 100 \times \left(1 - \frac{\text{Days}}{\text{Year}} \times DR\right)$$

$$PV = 100 \times \left(1 - \frac{180}{360} \times 0.0425\right)$$

$PV = 100 \times (1 - 0.02125)$

$PV = 100 \times 0.97875$

$PV = 97.875$

The bond equivalent yield (AOR) is calculated as:

$$AOR = \left(\frac{\text{Year}}{\text{Days}}\right) \times \left(\frac{FV - PV}{PV}\right)$$

where:

PV = present value, principal amount, or the price of the money market instrument
FV = future value, or the redemption amount paid at maturity including interest
Days = number of days between settlement and maturity
Year = number of days in the year
AOR = add-on rate (bond equivalent yield), stated as an annual percentage rate

$$AOR = \left(\frac{365}{180}\right) \times \left(\frac{100 - PV}{PV}\right)$$

$$AOR = \left(\frac{365}{180}\right) \times \left(\frac{100 - 97.875}{97.875}\right)$$

$$AOR = 2.02778 \times 0.02171$$

$$AOR = 0.04402\text{, or approximately } 4.40\%$$

Note that the PV is calculated using an assumed 360-day year and the AOR (bond equivalent yield) is calculated using a 365-day year.

35 B is correct. All bonds on a par curve are assumed to have similar, not different, credit risk. Par curves are obtained from spot curves and all bonds used to derive the par curve are assumed to have the same credit risk, as well as the same periodicity, currency, liquidity, tax status, and annual yields. A par curve is a sequence of yields-to-maturity such that each bond is priced at par value.

36 B is correct. The spot curve, also known as the strip or zero curve, is the yield curve constructed from a sequence of yields-to-maturities on zero-coupon bonds. The par curve is a sequence of yields-to-maturity such that each bond is priced at par value. The forward curve is constructed using a series of forward rates, each having the same timeframe.

37 B is correct. The forward rate can be interpreted to be the incremental or marginal return for extending the time-to-maturity of an investment for an additional time period. The add-on rate (bond equivalent yield) is a rate quoted for money market instruments such as bank certificates of deposit and indexes such as Libor and Euribor. Yield-to-maturity is the internal rate of return on the bond's cash flows—the uniform interest rate such that when the bond's future cash flows are discounted at that rate, the sum of the present values equals the price of the bond. It is the implied market discount rate.

38 B is correct. The 3 year implied spot rate is closest to 1.94%. It is calculated as the geometric average of the one-year forward rates:

$$(1.0080 \times 1.0112 \times 1.0394) = (1 + z_3)^3$$

$$1.05945 = (1 + z_3)^3$$

$$[1.05945]^{1/3} = [(1 + z_3)^3]^{1/3}$$

$$1.01944 = 1 + z_3$$

$$1.01944 - 1 = z_3$$

$$0.01944 = z_3,\ z_3 = 1.944\% \text{ or approximately } 1.94\%$$

39 B is correct. The value per 100 of par value is closest to105.01. Using the forward curve, the bond price is calculated as follows:

$$\frac{3.5}{1.0080} + \frac{103.5}{(1.0080 \times 1.0112)} = 3.47 + 101.54 = 105.01$$

40 C is correct. The spread component of a specific bond's yield-to-maturity is least likely impacted by changes in inflation of its currency of denomination. The effect of changes in macroeconomic factors, such as the expected rate of inflation in the currency of denomination, is seen mostly in changes in the benchmark yield. The spread or risk premium component is impacted by microeconomic factors specific to the bond and bond issuer including tax status and quality rating.

41 A is correct. The I-spread, or interpolated spread, is the yield spread of a specific bond over the standard swap rate in that currency of the same tenor. The yield spread in basis points over an actual or interpolated government bond is known as the G-spread. The Z-spread (zero-volatility spread) is the constant spread such that is added to each spot rate such that the present value of the cash flows matches the price of the bond.

42 B is correct. The G-spread is closest to 285 bps. The benchmark rate for UK fixed-rate bonds is the UK government benchmark bond. The Euro interest rate spread benchmark is used to calculate the G-spread for Euro-denominated corporate bonds, not UK bonds. The G-spread is calculated as follows:

Yield-to-maturity on the UK corporate bond:

$$100.65 = \frac{5}{(1+r)^1} + \frac{5}{(1+r)^2} + \frac{105}{(1+r)^3},\ r = \ 0.04762 \text{ or } 476 \text{ bps}$$

Yield-to-maturity on the UK government benchmark bond:

$$100.25 = \frac{2}{(1+r)^1} + \frac{2}{(1+r)^2} + \frac{102}{(1+r)^3},\ r = \ 0.01913 \text{ or } 191 \text{ bps}$$

The G-spread is 476 – 191 = 285 bps.

43 A is correct. The value of the bond is closest to 92.38. The calculation is:

$$\begin{aligned} PV &= \frac{PMT}{(1+z_1+Z)^1} + \frac{PMT}{(1+z_2+Z)^2} + \frac{PMT+FV}{(1+z_3+Z)^3} \\ &= \frac{5}{(1+0.0486+0.0234)^1} + \frac{5}{(1+0.0495+0.0234)^2} + \frac{105}{(1+0.0565+0.0234)^3} \\ &= \frac{5}{1.0720} + \frac{5}{1.15111} + \frac{105}{1.25936} = 4.66 + 4.34 + 83.38 = 92.38 \end{aligned}$$

44 C is correct. The option value in basis points per year is subtracted from the Z-spread to calculate the option-adjusted spread (OAS). The Z-spread is the constant yield spread over the benchmark spot curve. The I-spread is the yield spread of a specific bond over the standard swap rate in that currency of the same tenor.

PRACTICE PROBLEMS

1 Securitization is beneficial for banks because it:

A repackages bank loans into simpler structures.

B increases the funds available for banks to lend.

C allows banks to maintain ownership of their securitized assets.

2 Securitization benefits financial markets by:

A increasing the role of intermediaries.

B establishing a barrier between investors and originating borrowers.

C allowing investors to tailor credit risk and interest rate risk exposures to meet their individual needs.

3 A benefit of securitization is the:

A reduction in disintermediation.

B simplification of debt obligations.

C creation of tradable securities with greater liquidity than the original loans.

4 Securitization benefits investors by:

A providing more direct access to a wider range of assets.

B reducing the inherent credit risk of pools of loans and receivables.

C eliminating cash flow timing risks of an ABS, such as contraction and extension risks.

5 In a securitization, the special purpose entity (SPE) is responsible for the:

A issuance of the asset-backed securities.

B collection of payments from the borrowers.

C recovery of underlying assets from delinquent borrowers.

6 In a securitization, the collateral is initially sold by the:

A issuer.

B depositor.

C underwriter.

7 A special purpose entity issues asset-backed securities in the following structure.

Bond Class	Par Value (€ millions)
A (senior)	200
B (subordinated)	20
C (subordinated)	5

At which of the following amounts of default in par value would Bond Class A experience a loss?

A €20 million

B €25 million

C €26 million

8 In a securitization, time tranching provides investors with the ability to choose between:

PRACTICE PROBLEMS

1 A “buy-and-hold” investor purchases a fixed-rate bond at a discount and holds the security until it matures. Which of the following sources of return is *least likely* to contribute to the investor’s total return over the investment horizon, assuming all payments are made as scheduled?

   A Capital gain

   B Principal payment

   C Reinvestment of coupon payments

2 Which of the following sources of return is *most likely* exposed to interest rate risk for an investor of a fixed-rate bond who holds the bond until maturity?

   A Capital gain or loss

   B Redemption of principal

   C Reinvestment of coupon payments

3 An investor purchases a bond at a price above par value. Two years later, the investor sells the bond. The resulting capital gain or loss is measured by comparing the price at which the bond is sold to the:

   A carrying value.

   B original purchase price.

   C original purchase price value plus the amortized amount of the premium.

The following information relates to Problems 4–6

An investor purchases a nine-year, 7% annual coupon payment bond at a price equal to par value. After the bond is purchased and before the first coupon is received, interest rates increase to 8%. The investor sells the bond after five years. Assume that interest rates remain unchanged at 8% over the five-year holding period.

4 Per 100 of par value, the future value of the reinvested coupon payments at the end of the holding period is *closest* to:

   A 35.00.

   B 40.26.

   C 41.07.

5 The capital gain/loss per 100 of par value resulting from the sale of the bond at the end of the five-year holding period is *closest* to a:

   A loss of 8.45.

   B loss of 3.31.

   C gain of 2.75.

6 Assuming that all coupons are reinvested over the holding period, the investor’s five-year horizon yield is *closest* to:

   A 5.66%.

B 6.62%.

C 7.12%.

---

7 An investor buys a three-year bond with a 5% coupon rate paid annually. The bond, with a yield-to-maturity of 3%, is purchased at a price of 105.657223 per 100 of par value. Assuming a 5-basis point change in yield-to-maturity, the bond's approximate modified duration is *closest* to:

A 2.78.

B 2.86.

C 5.56.

8 Which of the following statements about duration is correct? A bond's:

A effective duration is a measure of yield duration.

B modified duration is a measure of curve duration.

C modified duration cannot be larger than its Macaulay duration (assuming a positive yield-to-maturity).

9 An investor buys a 6% annual payment bond with three years to maturity. The bond has a yield-to-maturity of 8% and is currently priced at 94.845806 per 100 of par. The bond's Macaulay duration is *closest* to:

A 2.62.

B 2.78.

C 2.83.

10 The interest rate risk of a fixed-rate bond with an embedded call option is *best* measured by:

A effective duration.

B modified duration.

C Macaulay duration.

11 Which of the following is *most* appropriate for measuring a bond's sensitivity to shaping risk?

A key rate duration

B effective duration

C modified duration

12 A Canadian pension fund manager seeks to measure the sensitivity of her pension liabilities to market interest rate changes. The manager determines the present value of the liabilities under three interest rate scenarios: a base rate of 7%, a 100 basis point increase in rates up to 8%, and a 100 basis point drop in rates down to 6%. The results of the manager's analysis are presented below:

Interest Rate Assumption	Present Value of Liabilities
6%	CAD 510.1 million
7%	CAD 455.4 million
8%	CAD 373.6 million

The effective duration of the pension fund's liabilities is *closest* to:

A 1.49.

B 14.99.

C 29.97.

13 Which of the following statements about Macaulay duration is correct?

A A bond's coupon rate and Macaulay duration are positively related.

B A bond's Macaulay duration is inversely related to its yield-to-maturity.

C The Macaulay duration of a zero-coupon bond is less than its time-to-maturity.

14 Assuming no change in the credit risk of a bond, the presence of an embedded put option:

A reduces the effective duration of the bond.

B increases the effective duration of the bond.

C does not change the effective duration of the bond.

15 A bond portfolio consists of the following three fixed-rate bonds. Assume annual coupon payments and no accrued interest on the bonds. Prices are per 100 of par value.

Bond	Maturity	Market Value	Price	Coupon	Yield-to-Maturity	Modified Duration
A	6 years	170,000	85.0000	2.00%	4.95%	5.42
B	10 years	120,000	80.0000	2.40%	4.99%	8.44
C	15 years	100,000	100.0000	5.00%	5.00%	10.38

The bond portfolio's modified duration is *closest* to:

A 7.62.

B 8.08.

C 8.20.

16 A limitation of calculating a bond portfolio's duration as the weighted average of the yield durations of the individual bonds that compose the portfolio is that it:

A assumes a parallel shift to the yield curve.

B is less accurate when the yield curve is less steeply sloped.

C is not applicable to portfolios that have bonds with embedded options.

17 Using the information below, which bond has the *greatest* money duration per 100 of par value assuming annual coupon payments and no accrued interest?

Bond	Time-to-Maturity	Price Per 100 of Par Value	Coupon Rate	Yield-to-Maturity	Modified Duration
A	6 years	85.00	2.00%	4.95%	5.42
B	10 years	80.00	2.40%	4.99%	8.44
C	9 years	85.78	3.00%	5.00%	7.54

A Bond A

B Bond B

C Bond C

18 A bond with exactly nine years remaining until maturity offers a 3% coupon rate with annual coupons. The bond, with a yield-to-maturity of 5%, is priced at 85.784357 per 100 of par value. The estimated price value of a basis point for the bond is *closest* to:

A 0.0086.

B 0.0648.

C 0.1295.

19 The "second-order" effect on a bond's percentage price change given a change in yield-to-maturity can be *best* described as:

A duration.

B convexity.

C yield volatility.

20 A bond is currently trading for 98.722 per 100 of par value. If the bond's yield-to-maturity (YTM) rises by 10 basis points, the bond's full price is expected to fall to 98.669. If the bond's YTM decreases by 10 basis points, the bond's full price is expected to increase to 98.782. The bond's approximate convexity is *closest* to:

A 0.071.

B 70.906.

C 1,144.628.

21 A bond has an annual modified duration of 7.020 and annual convexity of 65.180. If the bond's yield-to-maturity decreases by 25 basis points, the expected percentage price change is *closest* to:

A 1.73%.

B 1.76%.

C 1.78%.

22 A bond has an annual modified duration of 7.140 and annual convexity of 66.200. The bond's yield-to-maturity is expected to increase by 50 basis points. The expected percentage price change is *closest* to:

A –3.40%.

B –3.49%.

C –3.57%.

23 Which of the following statements relating to yield volatility is *most* accurate? If the term structure of yield volatility is downward sloping, then:

A short-term rates are higher than long-term rates.

B long-term yields are more stable than short-term yields.

C short-term bonds will always experience greater price fluctuation than long-term bonds.

24 The holding period for a bond at which the coupon reinvestment risk offsets the market price risk is *best* approximated by:

A duration gap.

B modified duration.

C Macaulay duration.

25 When the investor's investment horizon is less than the Macaulay duration of the bond she owns:

A the investor is hedged against interest rate risk.

B reinvestment risk dominates, and the investor is at risk of lower rates.

C market price risk dominates, and the investor is at risk of higher rates.

26 An investor purchases an annual coupon bond with a 6% coupon rate and exactly 20 years remaining until maturity at a price equal to par value. The investor's investment horizon is eight years. The approximate modified duration of the bond is 11.470 years. The duration gap at the time of purchase is *closest* to:

A –7.842.

B 3.470.

C 4.158.

27 A manufacturing company receives a ratings upgrade and the price increases on its fixed-rate bond. The price increase was *most likely* caused by a(n):

A decrease in the bond's credit spread.

B increase in the bond's liquidity spread.

C increase of the bond's underlying benchmark rate.

SOLUTIONS

1 A is correct. A capital gain is least likely to contribute to the investor's total return. There is no capital gain (or loss) because the bond is held to maturity. The carrying value of the bond at maturity is par value, the same as the redemption amount. When a fixed-rate bond is held to its maturity, the investor receives the principal payment at maturity. This principal payment is a source of return for the investor. A fixed-rate bond pays periodic coupon payments, and the reinvestment of these coupon payments is a source of return for the investor. The investor's total return is the redemption of principal at maturity and the sum of the reinvested coupons.

2 C is correct. Because the fixed-rate bond is held to maturity (a "buy-and-hold" investor), interest rate risk arises entirely from changes in coupon reinvestment rates. Higher interest rates increase income from reinvestment of coupon payments, and lower rates decrease income from coupon reinvestment. There will not be a capital gain or loss because the bond is held until maturity. The carrying value at the maturity date is par value, the same as the redemption amount. The redemption of principal does not expose the investor to interest rate risk. The risk to a bond's principal is credit risk.

3 A is correct. Capital gains (losses) arise if a bond is sold at a price above (below) its constant-yield price trajectory. A point on the trajectory represents the carrying value of the bond at that time. That is, the capital gain/loss is measured from the bond's carrying value, the point on the constant-yield price trajectory, and not from the original purchase price. The carrying value is the original purchase price plus the amortized amount of the discount if the bond is purchased at a price below par value. If the bond is purchased at a price above par value, the carrying value is the original purchase price minus (not plus) the amortized amount of the premium. The amortized amount for each year is the change in the price between two points on the trajectory.

4 C is correct. The future value of reinvested cash flows at 8% after five years is closest to 41.07per 100 of par value.

$$\left[7 \times (1.08)^4\right] + \left[7 \times (1.08)^3\right] + \left[7 \times (1.08)^2\right] + \left[7 \times (1.08)^1\right] + 7 = 41.0662$$

The 6.07 difference between the sum of the coupon payments over the five-year holding period (35) and the future value of the reinvested coupons (41.07) represents the "interest-on-interest" gain from compounding.

5 B is correct. The capital loss is closest to 3.31 per 100 of par value. After five years, the bond has four years remaining until maturity and the sale price of the bond is 96.69, calculated as:

$$\frac{7}{(1.08)^1} + \frac{7}{(1.08)^2} + \frac{7}{(1.08)^3} + \frac{107}{(1.08)^4} = 96.69$$

The investor purchased the bond at a price equal to par value (100). Because the bond was purchased at a price equal to its par value, the carrying value is par value. Therefore, the investor experienced a capital loss of 96.69 – 100 = –3.31.

6 B is correct. The investor's five-year horizon yield is closest to 6.62%. After five years, the sale price of the bond is 96.69 (from problem 5) and the future value of reinvested cash flows at 8% is 41.0662 (from problem 4) per 100 of par value. The total return is 137.76 (= 41.07 + 96.69), resulting in a realized five-year horizon yield of 6.62%:

$$100.00 = \frac{137.76}{(1+r)^5}, \quad r = 0.0662$$

7 A is correct. The bond's approximate modified duration is closest to 2.78. Approximate modified duration is calculated as:

$$\text{ApproxModDur} = \frac{(PV_-) - (PV_+)}{2 \times (\Delta\text{Yield}) \times (PV_0)}$$

Lower yield-to-maturity by 5 bps to 2.95%:

$$PV_- = \frac{5}{(1+0.0295)^1} + \frac{5}{(1+0.0295)^2} + \frac{5+100}{(1+0.0295)^3} = 105.804232$$

Increase yield-to-maturity by 5 bps to 3.05%:

$$PV_+ = \frac{5}{(1+0.0305)^1} + \frac{5}{(1+0.0305)^2} + \frac{5+100}{(1+0.0305)^3} = 105.510494$$

PV_0 = 105.657223, ΔYield = 0.0005

$$\text{ApproxModDur} = \frac{105.804232 - 105.510494}{2 \times 0.0005 \times 105.657223} = 2.78$$

8 C is correct. A bond's modified duration cannot be larger than its Macaulay duration assuming a positive yield-to-maturity. The formula for modified duration is:

$$\text{ModDur} = \frac{\text{MacDur}}{1+r}$$

where r is the bond's yield-to-maturity per period. Therefore, ModDur will typically be less than MacDur.

Effective duration is a measure of curve duration. Modified duration is a measure of yield duration.

9 C is correct. The bond's Macaulay duration is closest to 2.83. Macaulay duration (MacDur) is a weighted average of the times to the receipt of cash flow. The weights are the shares of the full price corresponding to each coupon and principal payment.

Period	Cash Flow	Present Value	Weight	Period × Weight
1	6	5.555556	0.058575	0.058575
2	6	5.144033	0.054236	0.108472
3	106	84.146218	0.887190	2.661570
		94.845806	1.000000	2.828617

Thus, the bond's Macaulay duration (MacDur) is 2.83.

Alternatively, Macaulay duration can be calculated using the following closed-form formula:

$$\text{MacDur} = \left\{\frac{1+r}{r} - \frac{1+r+\left[N\times(c-r)\right]}{c\times\left[(1+r)^N-1\right]+r}\right\} - (t/T)$$

$$\text{MacDur} = \left\{\frac{1.08}{0.08} - \frac{1.08+\left[3\times(0.06-0.08)\right]}{0.06\times\left[(1.08)^3-1\right]+0.08}\right\} - 0$$

MacDur = 13.50 – 10.67 = 2.83

10 A is correct. The interest rate risk of a fixed-rate bond with an embedded call option is best measured by effective duration. A callable bond's future cash flows are uncertain because they are contingent on future interest rates. The issuer's decision to call the bond depends on future interest rates. Therefore, the yield-to-maturity on a callable bond is not well defined. Only effective duration, which takes into consideration the value of the call option, is the appropriate interest rate risk measure. Yield durations like Macaulay and modified durations are not relevant for a callable bond because they assume no changes in cash flows when interest rates change.

11 A is correct. Key rate duration is used to measure a bond's sensitivity to a shift at one or more maturity segments of the yield curve which result in a change to yield curve shape. Modified and effective duration measure a bond's sensitivity to parallel shifts in the entire curve.

12 B is correct. The effective duration of the pension fund's liabilities is closest to 14.99. The effective duration is calculated as follows:

$$\text{EffDur} = \frac{(PV_-)-(PV_+)}{2\times(\Delta\text{Curve})\times(PV_0)}$$

PV_0 = 455.4, PV_+ = 373.6, PV_- = 510.1, and ΔCurve = 0.0100.

$$\text{EffDur} = \frac{510.1-373.6}{2\times 0.0100\times 455.4} = 14.99$$

13 B is correct. A bond's yield-to-maturity is inversely related to its Macaulay duration: The higher the yield-to-maturity, the lower its Macaulay duration and the lower the interest rate risk. A higher yield-to-maturity decreases the weighted average of the times to the receipt of cash flow, and thus decreases the Macaulay duration.

A bond's coupon rate is inversely related to its Macaulay duration: The lower the coupon, the greater the weight of the payment of principal at maturity. This results in a higher Macaulay duration. Zero-coupon bonds do not pay periodic coupon payments; therefore, the Macaulay duration of a zero-coupon bond is its time-to-maturity.

14 A is correct. The presence of an embedded put option reduces the effective duration of the bond, especially when rates are rising. If interest rates are low compared with the coupon rate, the value of the put option is low and the impact of the change in the benchmark yield on the bond's price is very similar to the impact on the price of a non-putable bond. But when benchmark interest rates rise, the put option becomes more valuable to the investor. The ability to

sell the bond at par value limits the price depreciation as rates rise. The presence of an embedded put option reduces the sensitivity of the bond price to changes in the benchmark yield, assuming no change in credit risk.

15 A is correct. The portfolio's modified duration is closest to 7.62.Portfolio duration is commonly estimated as the market-value-weighted average of the yield durations of the individual bonds that compose the portfolio.

The total market value of the bond portfolio is 170,000 + 120,000 + 100,000 = 390,000.

The portfolio duration is 5.42 × (170,000/390,000) + 8.44 × (120,000/390,000) + 10.38 × (100,000/390,000) = 7.62.

16 A is correct. A limitation of calculating a bond portfolio's duration as the weighted average of the yield durations of the individual bonds is that this measure implicitly assumes a parallel shift to the yield curve (all rates change by the same amount in the same direction). In reality, interest rate changes frequently result in a steeper or flatter yield curve. This approximation of the "theoretically correct" portfolio duration is *more* accurate when the yield curve is flatter (less steeply sloped). An advantage of this approach is that it can be used with portfolios that include bonds with embedded options. Bonds with embedded options can be included in the weighted average using the effective durations for these securities.

17 B is correct. Bond B has the greatest money duration per 100 of par value. Money duration (MoneyDur) is calculated as the annual modified duration (AnnModDur) times the full price (PV^{Full}) of the bond including accrued interest. Bond B has the highest money duration per 100 of par value.

$$\text{MoneyDur} = \text{AnnModDur} \times PV^{Full}$$

MoneyDur of Bond A = 5.42 × 85.00 = 460.70

MoneyDur of Bond B = 8.44 × 80.00 = 675.20

MoneyDur of Bond C = 7.54 × 85.78 = 646.78

18 B is correct. The PVBP is closest to 0.0648. The formula for the price value of a basis point is:

$$\text{PVBP} = \frac{(PV_{-}) - (PV_{+})}{2}$$

where:

PVBP = price value of a basis point

PV_{-} = full price calculated by lowering the yield-to-maturity by one basis point

PV_{+} = full price calculated by raising the yield-to-maturity by one basis point

Lowering the yield-to-maturity by one basis point to 4.99% results in a bond price of 85.849134:

$$PV_{-} = \frac{3}{(1+0.0499)^1} + \cdots + \frac{3+100}{(1+0.0499)^9} = 85.849134$$

Increasing the yield-to-maturity by one basis point to 5.01% results in a bond price of 85.719638:

$$PV_{+} = \frac{3}{(1+0.0501)^1} + \cdots + \frac{3+100}{(1+0.0501)^9} = 85.719638$$

$$\text{PVBP} = \frac{85.849134 - 85.719638}{2} = 0.06475$$

Alternatively, the PVBP can be derived using modified duration:

$$\text{ApproxModDur} = \frac{(PV_{-}) - (PV_{+})}{2 \times (\Delta\text{Yield}) \times (PV_0)}$$

$$\text{ApproxModDur} = \frac{85.849134 - 85.719638}{2 \times 0.0001 \times 85.784357} = 7.548$$

$$\text{PVBP} = 7.548 \times 85.784357 \times 0.0001 = 0.06475$$

19 B is correct. Convexity measures the "second order" effect on a bond's percentage price change given a change in yield-to-maturity. Convexity adjusts the percentage price change estimate provided by modified duration to better approximate the true relationship between a bond's price and its yield-to-maturity which is a curved line (convex).

Duration estimates the change in the bond's price along the straight line that is tangent to this curved line ("first order" effect). Yield volatility measures the magnitude of changes in the yields along the yield curve.

20 B is correct. The bond's approximate convexity is closest to 70.906. Approximate convexity (ApproxCon) is calculated using the following formula:

$$\text{ApproxCon} = [PV_{-} + PV_{+} - (2 \times PV_0)]/(\Delta\text{Yield}^2 \times PV_0)$$

where:

PV_{-} = new price when the yield-to-maturity is decreased
PV_{+} = new price when the yield-to-maturity is increased
PV_0 = original price
ΔYield = change in yield-to-maturity
ApproxCon = $[98.782 + 98.669 - (2 \times 98.722)]/(0.001^2 \times 98.722) = 70.906$

21 C is correct. The expected percentage price change is closest to 1.78%. The convexity-adjusted percentage price change for a bond given a change in the yield-to-maturity is estimated by:

$$\%\Delta PV^{Full} \approx [-\text{AnnModDur} \times \Delta\text{Yield}] + [0.5 \times \text{AnnConvexity} \times (\Delta\text{Yield})^2]$$

$\%\Delta PV^{Full} \approx [-7.020 \times (-0.0025)] + [0.5 \times 65.180 \times (-0.0025)^2] = 0.017754$, or 1.78%

22 B is correct. The expected percentage price change is closest to −3.49%. The convexity-adjusted percentage price change for a bond given a change in the yield-to-maturity is estimated by:

$$\%\Delta PV^{Full} \approx [-\text{AnnModDur} \times \Delta\text{Yield}] + [0.5 \times \text{AnnConvexity} \times (\Delta\text{Yield})^2]$$

$\%\Delta PV^{Full} \approx [-7.140 \times 0.005] + [0.5 \times 66.200 \times (0.005)^2] = -0.034873$, or −3.49%

23 B is correct. If the term structure of yield volatility is downward-sloping, then short-term bond yields-to-maturity have greater volatility than for long-term bonds. Therefore, long-term yields are more stable than short-term yields. Higher volatility in short-term rates does not necessarily mean that the level of short-term rates is higher than long-term rates. With a downward-sloping term structure of yield volatility, short-term bonds will not always experience greater price fluctuation than long-term bonds. The estimated percentage change in a bond price depends on the modified duration and convexity as well as on the yield-to-maturity change.

24 C is correct. When the holder of a bond experiences a one-time parallel shift in the yield curve, the Macaulay duration statistic identifies the number of years necessary to hold the bond so that the losses (or gains) from coupon reinvestment offset the gains (or losses) from market price changes. The duration gap is the difference between the Macaulay duration and the investment horizon. Modified duration approximates the percentage price change of a bond given a change in its yield-to-maturity.

25 C is correct. The duration gap is equal to the bond's Macaulay duration minus the investment horizon. In this case, the duration gap is positive, and price risk dominates coupon reinvestment risk. The investor risk is to higher rates.

The investor is hedged against interest rate risk if the duration gap is zero; that is, the investor's investment horizon is equal to the bond's Macaulay duration. The investor is at risk of lower rates only if the duration gap is negative; that is, the investor's investment horizon is greater than the bond's Macaulay duration. In this case, coupon reinvestment risk dominates market price risk.

26 C is correct. The duration gap is closest to 4.158. The duration gap is a bond's Macaulay duration minus the investment horizon. The approximate Macaulay duration is the approximate modified duration times one plus the yield-to-maturity. It is 12.158 (= 11.470 × 1.06).

Given an investment horizon of eight years, the duration gap for this bond at purchase is positive: 12.158 – 8 = 4.158. When the investment horizon is less than the Macaulay duration of the bond, the duration gap is positive, and price risk dominates coupon reinvestment risk.

27 A is correct. The price increase was most likely caused by a decrease in the bond's credit spread. The ratings upgrade most likely reflects a lower expected probability of default and/or a greater level of recovery of assets if default occurs. The decrease in credit risk results in a smaller credit spread. The increase in the bond price reflects a decrease in the yield-to-maturity due to a smaller credit spread. The change in the bond price was not due to a change in liquidity risk or an increase in the benchmark rate.

PRACTICE PROBLEMS

1 The risk that a bond's creditworthiness declines is *best* described by:

A credit migration risk.

B market liquidity risk.

C spread widening risk.

2 Stedsmart Ltd and Fignermo Ltd are alike with respect to financial and operating characteristics, except that Stedsmart Ltd has less publicly traded debt outstanding than Fignermo Ltd. Stedsmart Ltd is *most likely* to have:

A no market liquidity risk.

B lower market liquidity risk.

C higher market liquidity risk.

3 In the event of default, the recovery rate of which of the following bonds would *most likely* be the highest?

A First mortgage debt

B Senior unsecured debt

C Junior subordinate debt

4 During bankruptcy proceedings of a firm, the priority of claims was not strictly adhered to. Which of the following is the *least likely* explanation for this outcome?

A Senior creditors compromised.

B The value of secured assets was less than the amount of the claims.

C A judge's order resulted in actual claims not adhering to strict priority of claims.

5 A fixed income analyst is *least likely* to conduct an independent analysis of credit risk because credit rating agencies:

A may at times mis-rate issues.

B often lag the market in pricing credit risk.

C cannot foresee future debt-financed acquisitions.

6 If goodwill makes up a large percentage of a company's total assets, this *most likely* indicates that:

A the company has low free cash flow before dividends.

B there is a low likelihood that the market price of the company's common stock is below book value.

C a large percentage of the company's assets are not of high quality.

7 In order to analyze the **collateral** of a company a credit analyst should assess the:

A cash flows of the company.

B soundness of management's strategy.

C value of the company's assets in relation to the level of debt.

8 In order to determine the **capacity** of a company, it would be *most* appropriate to analyze the:

A company's strategy.

B growth prospects of the industry.

C aggressiveness of the company's accounting policies.

9 A credit analyst is evaluating the credit worthiness of three companies: a construction company, a travel and tourism company, and a beverage company. Both the construction and travel and tourism companies are cyclical, whereas the beverage company is non-cyclical. The construction company has the highest debt level of the three companies. The highest credit risk is *most likely* exhibited by the:

A construction company.

B beverage company.

C travel and tourism company.

10 Based on the information provided in Exhibit 1, the EBITDA interest coverage ratio of Adidas AG is *closest* to:

A 7.91x.

B 10.12x.

C 12.99x.

Exhibit 1 Adidas AG Excerpt from Consolidated Income Statement in a given year (€ in millions)

Gross profit	5,730
Royalty and commission income	100
Other operating income	110
Other operating expenses	5,046
Operating profit	894
Interest income	25
Interest expense	113
Income before taxes	806
Income taxes	238
Net income	568
Additional information:	
Depreciation and amortization: €249 million	

Source: Adidas AG Annual Financial Statements, December 2010

11 The following information is from the annual report of Adidas AG for December 2010:

- Depreciation and amortization: €249 million
- Total assets: €10,618 million
- Total debt: €1,613 million
- Shareholders' equity: €4,616 million

The debt/capital ratio of Adidas AG is *closest* to:

A 15.19%.

B 25.90%.

C 34.94%.

12 Funds from operations (FFO) of Pay Handle Ltd increased in 2011. In 2011 the total debt of the company remained unchanged, while additional common shares were issued. Pay Handle Ltd's ability to service its debt in 2011, as compared to 2010, *most likely*:

A improved.

B worsened.

C remained the same.

13 Based on the information in Exhibit 2, Grupa Zywiec SA's credit risk is *most likely*:

A lower than the industry.

B higher than the industry.

C the same as the industry.

Exhibit 2 European Food, Beverage, and Tobacco Industry and Grupa Zywiec SA Selected Financial Ratios for 2010

	Total debt/Total capital (%)	FFO/Total debt (%)	Return on capital (%)	Total debt/ EBITDA (x)	EBITDA interest coverage (x)
Grupa Zywiec SA	47.1	77.5	19.6	1.2	17.7
Industry Median	**42.4**	**23.6**	**6.55**	**2.85**	**6.45**

14 Based on the information in Exhibit 3, the credit rating of Davide Campari-Milano S.p.A. is *most likely*:

A lower than Associated British Foods plc.

B higher than Associated British Foods plc.

C the same as Associated British Foods plc.

Exhibit 3 European Food, Beverage, and Tobacco Industry; Associated British Foods plc; and Davide Campari-Milano S.p.A Selected Financial Ratios, 2010

Company	Total debt/total capital (%)	FFO/total debt (%)	Return on capital (%)	Total debt/EBITDA (x)	EBITDA interest coverage (x)
Associated British Foods plc	0.2	84.3	0.1	1.0	13.9
Davide Campari-Milano S.p.A.	42.9	22.9	8.2	3.2	3.2
European Food, Beverage, and Tobacco Median	**42.4**	**23.6**	**6.55**	**2.85**	**6.45**

15 Holding all other factors constant, the *most likely* effect of low demand and heavy new issue supply on bond yield spreads is that yield spreads will:

A widen.

B tighten.

C not be affected.

16 Credit risk of a corporate bond is *best* described as the:

A risk that an issuer's creditworthiness deteriorates.

B probability that the issuer fails to make full and timely payments.

C risk of loss resulting from the issuer failing to make full and timely payments.

17 The risk that the price at which investors can actually transact differs from the quoted price in the market is called:

A spread risk.

B credit migration risk.

C market liquidity risk.

18 Loss severity is *best* described as the:

A default probability multiplied by the loss given default.

B portion of a bond's value recovered by bondholders in the event of default.

C portion of a bond's value, including unpaid interest, an investor loses in the event of default.

19 The two components of credit risk are default probability and:

A spread risk.

B loss severity.

C market liquidity risk.

20 For a high-quality debt issuer with a large amount of publicly traded debt, bond investors tend to devote *most* effort to assessing the issuer's:

A default risk.

B loss severity.

C market liquidity risk.

21 The expected loss for a given debt instrument is estimated as the product of default probability and:

A (1 + Recovery rate).

B (1 – Recovery rate).

C 1/(1 + Recovery rate).

22 The priority of claims for senior subordinated debt is:

A lower than for senior unsecured debt.

B the same as for senior unsecured debt.

C higher than for senior unsecured debt.

23 A senior unsecured credit instrument holds a higher priority of claims than one ranked as:

A mortgage debt.

B second lien loan.

C senior subordinated.

24 In a bankruptcy proceeding, when the absolute priority of claims is enforced:

A senior subordinated creditors rank above second lien holders.

B preferred equity shareholders rank above unsecured creditors.

C creditors with a secured claim have the first right to the value of that specific property.

25 In the event of default, which of the following is *most likely* to have the highest recovery rate?

A Second lien

B Senior unsecured

C Senior subordinated

26 The process of moving credit ratings of different issues up or down from the issuer rating in response to different payment priorities is *best* described as:

A notching.

B structural subordination.

C cross-default provisions.

27 The factor considered by rating agencies when a corporation has debt at both its parent holding company and operating subsidiaries is *best* referred to as:

A credit migration risk.

B corporate family rating.

C structural subordination.

28 Which type of security is *most likely* to have the same rating as the issuer?

A Preferred stock

B Senior secured bond

C Senior unsecured bond

29 Which of the following corporate debt instruments has the highest seniority ranking?

A Second lien

B Senior unsecured

C Senior subordinated

30 An issuer credit rating usually applies to a company's:

A secured debt.

B subordinated debt.

C senior unsecured debt.

31 The rating agency process whereby the credit ratings on issues are moved up or down from the issuer rating *best* describes:

A notching.

B pari passu ranking.

C cross-default provisions.

32 The notching adjustment for corporate bonds rated Aa2/AA is *most likely*:

A larger than the notching adjustment for corporate bonds rated B2/B.

B the same as the notching adjustment for corporate bonds rated B2/B.

C smaller than the notching adjustment for corporate bonds rated B2/B.

33 Which of the following statements about credit ratings is *most accurate*?

A Credit ratings can migrate over time.

B Changes in bond credit ratings precede changes in bond prices.

C Credit ratings are focused on expected loss rather than risk of default.

34 Which industry characteristic *most likely* has a positive effect on a company's ability to service debt?

A Low barriers to entry in the industry

B High number of suppliers to the industry

C Broadly dispersed market share among large number of companies in the industry

35 When determining the capacity of a borrower to service debt, a credit analyst should begin with an examination of:

A industry structure.

B industry fundamentals.

C company fundamentals.

36 Which of the following accounting issues should *mostly likely* be considered a character warning flag in credit analysis?

A Expensing items immediately

B Changing auditors infrequently

C Significant off-balance-sheet financing

37 In credit analysis, capacity is *best* described as the:

A quality of management.

B ability of the borrower to make its debt payments on time.

C quality and value of the assets supporting an issuer's indebtedness.

38 Among the Four Cs of credit analysis, the recognition of revenue prematurely *most likely* reflects a company's:

A character.

B covenants.

C collateral.

Use the following Exhibit for Questions 39 and 40

Exhibit 4 Industrial Comparative Ratio Analysis, Year 20XX

	EBITDA Margin (%)	Return on Capital (%)	EBIT/ Interest Expense (×)	EBITDA/ Interest Expense (×)	Debt/ EBITDA (×)	Debt/ Capital (%)
Company A	25.1	25.0	15.9	19.6	1.6	35.2
Company B	29.6	36.3	58.2	62.4	0.5	15.9
Company C	21.8	16.6	8.9	12.4	2.5	46.3

39 Based on only the leverage ratios in Exhibit 4, the company with the *highest* credit risk is:

A Company A.

B Company B.

C Company C.

40 Based on only the coverage ratios in Exhibit 4, the company with the *highest* credit quality is:

A Company A.

B Company B.

C Company C.

Use the following Exhibits for Questions 41 and 42

Exhibit 5 Consolidated Income Statement (£ millions)

	Company X	Company Y
Net revenues	50.7	83.7
Operating expenses	49.6	70.4
Operating income	1.1	13.3
Interest income	0.0	0.0
Interest expense	0.6	0.8
Income before income taxes	0.5	12.5
Provision for income taxes	–0.2	–3.5
Net income	0.3	9.0

Exhibit 6 Consolidated Balance Sheets (£ millions)

	Company X	Company Y
ASSETS		
Current assets	10.3	21.9
Property, plant, and equipment, net	3.5	20.1
Goodwill	8.3	85.0
Other assets	0.9	5.1
Total assets	23.0	132.1
LIABILITIES AND SHAREHOLDERS' EQUITY		
Current liabilities		
Accounts payable and accrued expenses	8.4	16.2
Short-term debt	0.5	8.7

(continued)

Exhibit 6 (Continued)

	Company X	Company Y
Total current liabilities	8.9	24.9
Long-term debt	11.7	21.1
Other non-current liabilities	1.1	22.1
Total liabilities	21.7	68.1
Total shareholders' equity	1.3	64.0
Total liabilities and shareholders' equity	23.0	132.1

Exhibit 7 Consolidated Statements of Cash Flow (£ millions)

	Company X	Company Y
CASH FLOWS FROM OPERATING ACTIVITIES		
Net income	0.3	9.0
Depreciation	1.0	3.8
Goodwill impairment	2.0	1.6
Changes in working capital	0.0	–0.4
Net cash provided by operating activities	3.3	14.0
CASH FLOWS FROM INVESTING ACTIVITIES		
Additions to property and equipment	–1.0	–4.0
Additions to marketable securities	–0.1	0.0
Proceeds from sale of property and equipment	0.2	2.9
Proceeds from sale of marketable securities	0.3	0.0
Net cash used in investing activities	–0.6	–1.1
CASH FLOWS FROM FINANCING ACTIVITIES		
Repurchase of common stock	–1.5	–4.0
Dividends to shareholders	–0.3	–6.1
Change in short-term debt	0.0	–3.4
Additions to long-term debt	3.9	3.9
Reductions in long-term debt	–3.4	–2.5
Net cash – financing activities	–1.3	–12.1

Exhibit 7 (Continued)

	Company X	Company Y
NET INCREASE IN CASH AND CASH EQUIVALENTS	1.4	0.8

41 Based on Exhibits 5–7, in comparison to Company X, Company Y has a higher:
- A debt/capital ratio.
- B debt/EBITDA ratio.
- C free cash flow after dividends/debt ratio.

42 Based on Exhibits 5–7, in comparison to Company Y, Company X has greater:
- A leverage.
- B interest coverage.
- C operating profit margin.

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43 Credit yield spreads *most likely* widen in response to:
- A high demand for bonds.
- B weak performance of equities.
- C strengthening economic conditions.

44 The factor that *most likely* results in corporate credit spreads widening is:
- A an improving credit cycle.
- B weakening economic conditions.
- C a period of high demand for bonds.

45 Credit spreads are *most likely* to widen:
- A in a strengthening economy.
- B as the credit cycle improves.
- C in periods of heavy new issue supply and low borrower demand.

46 Which of the following factors in credit analysis is more important for general obligation non-sovereign government debt than for sovereign debt?
- A Per capita income
- B Power to levy and collect taxes
- C Requirement to balance an operating budget

47 In contrast to high-yield credit analysis, investment-grade analysis is *more likely* to rely on:
- A spread risk.
- B an assessment of bank credit facilities.
- C matching of liquidity sources to upcoming debt maturities.

48 Which of the following factors would *best* justify a decision to avoid investing in a country's sovereign debt?
- A Freely floating currency

B A population that is not growing

C Suitable checks and balances in policymaking

SOLUTIONS

1 A is correct. Credit migration risk or downgrade risk refers to the risk that a bond issuer's creditworthiness may deteriorate or migrate lower. The result is that investors view the risk of default to be higher, causing the spread on the issuer's bonds to widen.

2 C is correct. Market liquidity risk refers to the risk that the price at which investors transact may be different from the price indicated in the market. Market liquidity risk is increased by (1) less debt outstanding and/or (2) a lower issue credit rating. Because Stedsmart Ltd is comparable to Fignermo Ltd except for less publicly traded debt outstanding, it should have higher market liquidity risk.

3 A is correct. First mortgage debt is senior secured debt and has the highest priority of claims. First mortgage debt also has the highest expected recovery rate. First mortgage debt refers to the pledge of specific property. Neither senior unsecured nor junior subordinate debt has any claims on specific assets.

4 B is correct. Whether or not secured assets are sufficient for the claims against them does not influence priority of claims. Any deficiency between pledged assets and the claims against them becomes senior unsecured debt and still adheres to the guidelines of priority of claims.

5 C is correct. Both analysts and ratings agencies have difficulty foreseeing future debt-financed acquisitions.

6 C is correct. Goodwill is viewed as a lower quality asset compared with tangible assets that can be sold and more easily converted into cash.

7 C is correct. The value of assets in relation to the level of debt is important to assess the collateral of the company; that is, the quality and value of the assets that support the debt levels of the company.

8 B is correct. The growth prospects of the industry provide the analyst insight regarding the capacity of the company.

9 A is correct. The construction company is both highly leveraged, which increases credit risk, and in a highly cyclical industry, which results in more volatile earnings.

10 B is correct. The interest expense is €113 million and EBITDA = Operating profit + Depreciation and amortization = €894 + 249 million = €1,143 million. EBITDA interest coverage = EBITDA/Interest expense = 1,143/113 = 10.12 times.

11 B is correct. Total debt is €1,613 million with Total capital = Total debt + Shareholders' equity = €1,613 + 4,616 = €6,229 million. The Debt/Capital ratio = 1,613/6,229 = 25.90%.

12 A is correct. If the debt of the company remained unchanged but FFO increased, more cash is available to service debt compared to the previous year. Additionally, the debt/capital ratio has improved. It would imply that the ability of Pay Handle Ltd to service their debt has improved.

13 A is correct. Based on four of the five credit ratios, Grupa Zywiec SA's credit quality is superior to that of the industry.

14 A is correct. Davide Campari-Milano S.p.A. has more financial leverage and less interest coverage than Associated British Foods plc, which implies greater credit risk.

15 A is correct. Low demand implies wider yield spreads, while heavy supply will widen spreads even further.

16 C is correct. Credit risk is the risk of loss resulting from the borrower failing to make full and timely payments of interest and/or principal.

17 C is correct. Market liquidity risk is the risk that the price at which investors can actually transact—buying or selling—may differ from the price indicated in the market.

18 C is correct. Loss severity is the portion of a bond's value (including unpaid interest) an investor loses in the event of default.

19 B is correct. The two components of credit risk are default probability and loss severity. In the event of default, loss severity is the portion of a bond's value (including unpaid interest) an investor loses. A and C are incorrect because spread and market liquidity risk are credit-related risks, not components of credit risk.

20 A is correct. Credit risk has two components: default risk and loss severity. Because default risk is quite low for most high-quality debt issuers, bond investors tend to focus more on this likelihood and less on the potential loss severity.

21 B is correct. The expected loss for a given debt instrument is the default probability multiplied by the loss severity given default. The loss severity is often expressed as (1 – Recovery rate).

22 A is correct. Senior subordinated debt is ranked lower than senior unsecured debt and thus has a lower priority of payment.

23 C is correct. The highest-ranked unsecured debt is senior unsecured debt. Lower-ranked debt includes senior subordinated debt. A and B are incorrect because mortgage debt and second lien loans are secured and higher ranked.

24 C is correct. According to the absolute priority of claims, in the event of bankruptcy, creditors with a secured claim have the right to the value of that specific property before any other claim.

25 A is correct. A second lien has a secured interest in the pledged assets. Second lien debt ranks higher in priority of payment than senior unsecured and senior subordinated debt and thus would most likely have a higher recovery rate.

26 A is correct. Notching is the process for moving ratings up or down relative to the issuer rating when rating agencies consider secondary factors, such as priority of claims in the event of a default and the potential loss severity.

27 C is correct. Structural subordination can arise when a corporation with a holding company structure has debt at both its parent holding company and operating subsidiaries. Debt at the operating subsidiaries is serviced by the cash flow and assets of the subsidiaries before funds are passed to the parent holding company.

28 C is correct. The issuer credit rating usually applies to its senior unsecured debt.

29 A is correct. Second lien debt is secured debt, which is senior to unsecured debt and to subordinated debt.

30 C is correct. An issuer credit rating usually applies to its senior unsecured debt.

31 A is correct. Recognizing different payment priorities, and thus the potential for higher (or lower) loss severity in the event of default, the rating agencies have adopted a notching process whereby their credit ratings on issues can be moved up or down from the issuer rating (senior unsecured).

32 C is correct. As a general rule, the higher the senior unsecured rating, the smaller the notching adjustment. Thus, for corporate bonds rated Aa2/AA, the rating agencies will typically apply smaller rating adjustments, or notches, to the related issue.

33 A is correct. Credit migration is the risk that a bond issuer's creditworthiness deteriorates, or migrates lower. Over time, credit ratings can migrate significantly from what they were at the time a bond was issued. An investor should not assume that an issuer's credit rating will remain the same from the time of purchase through the entire holding period.

34 B is correct. An industry with a high number of suppliers reduces the suppliers' negotiating power, thus helping companies control expenses and aiding in the servicing of debt.

35 A is correct. Credit analysis starts with industry structure—for example, by looking at the major forces of competition, followed by an analysis of industry fundamentals—and then turns to examination of the specific issuer.

36 C is correct. Credit analysts can make judgments about management's character by evaluating the use of aggressive accounting policies, such as timing revenue recognition. This activity is a potential warning flag for other behaviors or actions that may adversely affect an issuer's creditworthiness.

37 B is correct. Capacity refers to the ability of a borrower to service its debt. Capacity is determined through credit analysis of an issuer's industry and of the specific issuer.

38 A is correct. Credit analysts can make judgments about management's character in a number of ways, including by observing its use of aggressive accounting policies and/or tax strategies. An example of this aggressiveness is recognizing revenue prematurely.

39 C is correct. The debt/capital and debt/EBITDA ratios are used to assess a company's leverage. Higher leverage ratios indicate more leverage and thus higher credit risk. Company C's debt/capital (46.3%) and debt/EBITDA (2.5×) leverage ratios are higher than those for Companies A and B.

40 B is correct. The EBITDA/interest expense and EBIT/interest expense ratios are coverage ratios. Coverage ratios measure an issuer's ability to meet its interest payments. A higher ratio indicates better credit quality. Company B's EBITDA/interest expense (62.4×) and EBIT/interest expense (58.2×) coverage ratios are higher than those for Companies A and C.

41 C is correct because Company Y has a higher ratio of free cash flow after dividends to debt than Company X, not lower, as shown in the following table.

$$\text{Free cash flow after dividends as a \% of debt} = \frac{\text{FCF after dividends}}{\text{Debt}}$$

	Company X	**Company Y**
Cash flow from operations	£3.3	£14.0
Less		
Net capital expenditures	–0.8	–1.1
Dividends	–0.3	–6.1
Free cash flow after dividends	£2.2	£6.8
Debt	£12.2	£29.8

(continued)

	Company X	Company Y
Free cash flow after dividends as a % of debt	(2.2/12.2) × 100	(6.8/29.8) × 100
Free cash flow after dividends as a % of debt	18.0%	22.8%

A is incorrect. Company Y has a lower debt/capital ratio than Company X, as shown in the following table.

$$\text{Debt divided by Capital (\%)} = \frac{\text{Debt}}{(\text{Debt} + \text{Equity})}$$

	Company X	Company Y
Debt	£12.2	£29.8
Capital		
Debt	12.2	29.8
+ Equity	1.3	64.0
Capital	£13.5	£93.8
Debt/Capital (%)	(12.2/13.5) × 100	(29.8/93.8) × 100
Debt/Capital (%)	90.4%	31.8%

B is incorrect because Company Y has a lower debt/EBITDA ratio than Company Y, not higher, as shown in the following table.

	Company X	Company Y
Operating income	£1.1	£13.3
EBIT	£1.1	£13.3
plus		
Depreciation	1.0	3.8
Amortization	0.0	0.0
EBITDA	£2.1	£17.1
Debt	£12.2	£29.8
Debt/EBITDA	12.2/2.1	29.8/17.1
Debt/EBITDA	5.81	1.74

42 A is correct. Compared with Company Y, based on both their debt/capital ratios and their ratios of free cash flow after dividends to debt, which are measures of leverage commonly used in credit analysis, Company X is more highly leveraged, as shown in the following table.

$$\text{Debt divided by Capital (\%)} = \frac{\text{Debt}}{(\text{Debt} + \text{Equity})}$$

	Company X	Company Y
Debt	£2.2	£29.8

	Company X	Company Y
Capital		
Debt	2.2	29.8
+ Equity	4.3	64.0
Capital	£6.5	£93.8
Debt/Capital (%)	(12.2/13.5) × 100	(29.8/93.8) × 100
Debt/Capital (%)	90.4%	31.8%

$$\text{Free cash flow after dividends as a \% of debt} = \frac{\text{FCF after dividends}}{\text{Debt}}$$

	Company X	Company Y
Cash flow from operations	£3.3	£14.0
Less		
Net capital expenditures	–0.8	–1.1
Dividends	–0.3	–6.1
Free cash flow after dividends	£2.2	£6.8
Debt	£12.2	£29.8
Free cash flow after dividends as a % of debt	(2.2/12.2) × 100	(6.8/29.8) × 100
Free cash flow after dividends as a % of debt	18.0%	22.8%

43 B is correct. In weak financial markets, including weak markets for equities, credit spreads will widen.

44 B is correct. Weakening economic conditions will push investors to desire a greater risk premium and drive overall credit spreads wider.

45 C is correct. In periods of heavy new issue supply, credit spreads will widen if demand is insufficient.

46 C is correct. Non-sovereign governments typically must balance their operating budgets and lack the discretion to use monetary policy as many sovereigns can.

47 A is correct. Most investors in investment-grade debt focus on spread risk—that is, the effect of changes in spreads on prices and returns—while in high-yield analysis, the focus on default risk is relatively greater.

48 B is correct. Among the most important considerations in sovereign credit analysis is growth and age distribution of population. A relatively young and growing population contributes to growth in GDP and an expanding tax base and relies less on social services, pensions, and health care relative to an older population.

Derivatives

STUDY SESSION

Study Session 16	Derivatives

TOPIC LEVEL LEARNING OUTCOME

The candidate should be able to demonstrate a working knowledge of the analysis of derivatives, including forwards, futures, options, and swaps.

Derivatives—financial instruments whose prices are derived from the value of some underlying asset—have become increasingly important for managing financial risk, exploiting investment opportunities, and creating synthetic asset class exposure. As in other security markets, arbitrage and market efficiency play a critical role in establishing prices for these securities.